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Journal of the Royal Army Medical Corps.

Original Communications.


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[Received May 22, 1945.]

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J. SUMMARY.

FOREWORD


The health records of the Forces in the Middle East, including those operating in the desert campaigns and the subsequent fighting in Cyrenaica and Tripolitania, compare more than favourably with those of other theatres of war in the past. The high standards of health, and the physical and mental fitness achieved, were only made possible by the untiring efforts of those responsible for the organization for the maintenance of the health of the troops and the prevention of disease, and by the whole-hearted co-operation of everyone from Commanders down to the Private soldier himself.

This article demonstrates the difficulties that were met with in the Middle East from the hygiene aspect and gives information showing how the many problems were handled. It illustrates also a wider concept of the present-day responsibilities of military medical authorities than is probably appreciated by many, even by members of the medical profession. This concern in the application of modern preventive medicine and hygiene has made a heavy demand on the technical resources of the Medical Services, especially under the complex conditions of the Middle East, during the difficult times of 1942.

Study of this account should therefore afford food for thought for all medical men interested in this aspect of military medical work. It will also be read with profit by many laymen to whom public health matters, whether of a type peculiar to the fighting services or of a more general kind, are of interest.

The authors are to be congratulated on so ably presenting this excellent picture of the Hygiene " War " in the Western Desert during 1942 and 1943.

A. THE CONSTITUTION, ENVIRONMENT AND ACTIVITIES OF THE MIDDLE EAST FORCE.

It is doubtful if military history has previously shown, or will ever exhibit again, the complex that characterized the Middle East Force during 1942 and 1943. Its soldiers came from three-quarters of the globe. There were men from the temperate climates of the United Kingdom, France, Belgium, Poland, Yugoslavia, Greece, Australia, New Zealand and South Africa. There were Africans from every part of the Continent—east, west, and the High Commission Territories of the south. There were Indians of all types, and men from such Indian Ocean islands as Mauritius, Ceylon and Seychelles. There were finally the groups recruited locally—Palestinians, Maltese, Cypriots, Syrians, Arabs, Iraqians and Sudanese. The soldiers of all these races were compounded into a mighty army which, as Mr. Churchill said in a broadcast in 1942, numbered nearly a million men. These million men were distributed amongst the Eighth Army in the Western Desert of Egypt and Libya, the Ninth Army in the Lebanon and Syria, and the garrisons and base installations of Cyprus, Malta, Palestine, Egypt, Aden, Sudan and Eritrea. Their campaigns were conducted amongst equally heterogeneous civilian communities, where colour, religion, customs and state of urban and rural development were infinitely varied. Arabs, Syrians, Lebanese, Jews, Copts, Moslems, Negroes, Ethiopians, Christians, Europeans, were all represented. From these civilian communities came over a quarter of a million men to move the stores and to build the warehouses, workshops, roads, railways, docks, barracks, hospitals and fortresses demanded by the Middle East Force.

The physical and climatic environment containing these armies and communities showed
extremes too. In the west, south, and east were the immense sandy and gravel deserts of the Sahara, the Sinai and Arabia. Here days and nights were hot and dry in summer, but in winter tolerable days too frequently were succeeded by bitterly cold nights. In the mountains of the Lebanon and Palestine, snow and sleet created arctic conditions in winter. The Delta of Egypt, the Nile Valley and the coastal plains of Palestine and Syria are green with vegetation and foliage. However, except for some patches in Palestine, Syria and Cyprus, forests are wanting in the Middle East scene. This geographical setting was immense. It covered the Mediterranean, the eastern half including the islands of Malta and Cyprus. In it there were half a dozen States with their own national systems—Syria, Palestine, Egypt, Sudan, Eritrea and Libya. It possessed thousands of miles of waterways in the Nile and its Delta, along which moved hundreds of barges and tugs carrying warlike stores. The common railway system, extending a thousand miles from Tobruk in the west, through Egypt, Palestine and Syria to link with the Turkish railways and so with Europe, owed its completion to Army engineers from South Africa, Australia and New Zealand. A vast telephone system produced a clear voice in Cairo from Baghdad as easily as it did from Benghazi. It possessed in Cairo, Alexandria, Beirut, Tel Aviv, Haifa, Jerusalem and Damascus, mighty Oriental cities from which came manufactured products and other supplies, and to which soldiers streamed in thousands on leave.

The constitution of the Middle East Force and its environment provide some of the background of the story of its health. A further important factor lay in its activities during 1942 and 1943. The spectacular role was played by the Eighth Army in the Western Desert. This was in three stages—the static first stage when the Eighth Army faced the enemy at Gazala, the second in the unhappy retreat in May and June, 1942, back through Tobruk, Mersa Matruh to El Alamein, and then the final stage in the victorious advance from here to Tunisia, reached in March, 1943, and culminating in the combined operation against Sicily. In the Sicilian Campaign the Eighth Army remained a Middle East responsibility for administrative purposes until August, 1943, after which it passed under the control of Allied Forces Headquarters in North Africa. Thereafter, only the unhappy incident of the Dodecanese Islands, when Leros, Cos and Lemnos changed hands twice, was to be classified as an operation. The shift of the war to Italy changed the nature of the Middle East Force so that, at the end of 1943, its importance lay not in actual fighting but in guarding the vital communications through the Suez Canal, acting as an insurance for peace in the important group of countries in the Eastern Mediterranean, and in developing its workshops and warehouses to suit the needs of armies elsewhere.

This aspect of the importance of the Middle East Force has been naturally overshadowed by the desert campaigns, but should not be minimized. The Force went a long way to becoming self-supporting. It obtained much of its food locally, it achieved miracles of manufacture and improvisation in meeting the immense demand for every conceivable article used by an army—mines, clothing, machinery, vehicles, weapons, hardware, medical apparatus. Its repair shops kept vast numbers of both ordinary and armed vehicles going, and guns and apparatus of all kinds ready for use. As well, therefore, as the special problems of war, the Middle East Force had also to concern itself with many health and medical aspects of an industrial community.

B. THE HEALTH AND MEDICAL ORGANIZATION.

The medical organization had its origins in the peace-time British garrisons of Egypt and Palestine from which the first members of the medical branch of G.H.Q., M.E.F., were recruited. This branch eventually expanded to form in 1942 and 1943 a large administrative office under the Director of Medical Services, a Major-General. It was modelled on the usual British Army lines with sub-directorates for planning and organization, personnel, hygiene, nursing, dental, pathological and laboratory services. A group of consultants and advisers covering most of the specialities of medicine and surgery was attached to the branch. It had available, too, laboratories equipped to tackle pathological, bacteriological, entomological, food and
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chemical problems. The important principle to be noted in this arrangement, typical of the British Army anywhere, is that the D.M.S. has two distinct functions at headquarters. In the official words:—"He is the adviser of the Commander-in-Chief on all medical and other matters affecting the health of the troops, and is responsible to him for the medical and health services of the force."

The responsibility of the D.M.S. for the medical and health services of the Army is an executive function. It is this, with its handling of sick and casualties and its use of such medical units as field ambulances and hospitals, which is best known both to the Army and the general public. Yet absorption in its urgency and importance to the detriment of less spectacular preventive medicine and public health needs of the Army would mean an incomplete observance and interpretation by the Medical Services of their duty to the Army. This is a distinct danger, various aspects of which it is proposed to discuss on some future occasion.

Following the usual system of decentralization, the Middle East command had a number of local area and sub-area commands, apart from its operational forces of the Eighth and Ninth Armies, etc. These subsidiary headquarters possessed senior medical officers administering the local medical functions. In each headquarters, a hygiene officer acted as a technical adviser in his field. Some of these local commands were immense, with correspondingly large and varied medical responsibilities. The most prominent operational command—Eighth Army—was completely self-contained in having a headquarters medical branch, and medical staffs at the headquarters of the corps and divisions. Field ambulances, field hygiene sections, casualty clearing stations, and such special units as hygiene, malaria and pathological laboratories, dental, blood transfusion, surgical and other special units were lavishly provided.

In the static or area commands, the most complex and largest was that responsible for Egypt. In its executive function of providing medical services it held large numbers of both general and special hospitals containing thousands of beds. Not only were these for local troops but were also the main hospital provision for the Eighth Army and such other areas as Cyrenaica and Tripolitania. Other medical functions were involved in the case of convalescents in various depots, in the examination and regrading of thousands of men returned to depots or discharged from hospital, in the ordinary everyday medical treatment and examination of men in units and depots. The health organization in this command consisted of a hygiene specialist at Command Headquarters, and at each area and sub-area, a total of eight in all. Field hygiene sections under the area hygiene officers maintained a supervisory and advisory role over the troops, camps, barracks, factories, workshops, depots, in their areas. The hygiene officers and field hygiene sections whose area contained large urban communities, such as Cairo, Alexandria, Port Said, etc., had, in addition, large responsibilities in supervising premises used by the troops on leave or for recreation—hostels, hotels, leave camps, cafes, etc.

On a smaller scale, local medical and health staffs supervised the medical treatment and health and sanitary needs of Palestine, Syria, the Lebanon, Cyprus, Malta, Cyrenaica, Tripolitania, the Sudan, Eritrea and Aden.

All routine provision of medical supervision, care and treatment, and of the machinery to maintain the troops' health, protected from infectious disease and suitably clothed, fed and housed, was thus met by this system of decentralized medical authorities. All major problems of direction, policy and co-ordination were left for handling by the Medical Branch of General Headquarters.

These various medical staffs supervising, advising and directing, from General Headquarters down through Army, Corps and Divisional Headquarters on the one hand, and Command, Area and Sub-Area Headquarters on the other, ultimately depended for the successful execution of their duties on the various medical units and on the regimental medical officers. It is through the regimental medical officer that the ultimate dual health and medical functions are mainly undertaken. In the Middle East, as elsewhere, the unit medical officer has watched over the health of the soldier, treated him when ill, sent him to hospital when his condition put him out of action, supervised his environment, his food, exercise, clothing, recreation and, in fact, all his activities in their health aspects. The unit medical officer has had the help in
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major problems of hygiene personnel and of field malaria units. However, his success has depended always on the willingness, interest and enthusiasm of the commanding officer who has the ultimate responsibility for the health of his troops, whether he be Army, Divisional, Brigade or Battalion commander.

C. HYGIENE TRAINING AND EDUCATION.

The heterogeneous Army of the Middle East included many disciplined self-reliant troops accustomed to hot climates and tropical diseases but, on the other hand, there were large groups who either entered it as local raw recruits or arrived from other countries and climates unprepared for the special hazards of the desert and delta and the Mediterranean littoral. Attitudes to the importance of disease and to the need for high standards of health and cleanliness consequently varied considerably. There were units with a high degree of discipline, actuated by the belief that their sick rate could be controlled, and others still accepting dirt, defect, disease and death fatally. A mixed problem of training, education and propaganda was thus presented. Many units and individuals had the right principles but not sufficient practice to safeguard themselves fully or to achieve the maximum of physical and mental well-being. Others were simply contemptuous of real soldiers bothering themselves with anything so childish or mundane as killing flies, avoiding mosquitoes or being particular as to the state of cleanliness of their camps, kitchens or their persons.

As far as possible, British principle and method were used, partly because the vast bulk of the Middle East Force was of British origin, partly to secure the advantages of uniformity and partly as these were known by previous experience to be suited to the local problems. Conversion of the potential and actual leaders of the Army to the importance of hygiene led to special emphasis to its principles being given in courses for staff officers and in the programme of officer training units. Formal training was undertaken by one specially established institution—The Middle East School of Hygiene—and by hygiene officers and field hygiene sections in each Force and Area. The School of Hygiene accomplished an enormous programme. There were formal courses of lectures and demonstrations held each month for groups of medical officers, regimental officers and non-commissioned officers, and rank and file. The subjects taught covered hygiene in all its aspects, field sanitation and water control. Drawn from the Eighth and Ninth Armies and from each base and other area, nearly 200 individuals a month passed through these formal courses, to return to their units, it was hoped, as disciples of the gospel of hygiene. This was important work and enabled modern hygiene method and knowledge to be quickly disseminated throughout the Middle East. But over and above such set programmes the School was continually filled to capacity with groups gathered together informally. These were of all kinds. There were medical and hygiene officers newly arrived, others standing by for new appointments, combatant officers, sanitary and water duty personnel from local units and many others. The School also helped in the initiation of non-British formations into local hygiene methods. Cadres from Polish, Belgian and other allied groups were trained for this purpose which, in their turn, established hygiene training units in their own forces. The teaching was naturally severely practical but kept dynamic and up to date. This was achieved by the constant contact the School maintained with field problems and by a programme of research and investigation. Many outworn practices and principles were revealed and discarded and more rational methods substituted. For example, in the case of excremental disease, a major cause of wastage of man power, methods of prevention were rigorously reviewed. As a result fly control was scientifically planned and proper methods taught, such as the destruction of breeding material in improvised incinerators and by the harmless disposal of human faeces in the famous incinerator petrol-tin latrine. This converted a previously difficult problem of latrines in the desert to a simple one. Fly traps were evolved which when placed away from cookhouses and mess-tents and baited with moist material did reduce fly populations and divert flies from contaminating food.

Considerable ingenuity was achieved in improvisation without which field units especially could scarcely have carried out their sanitary functions. The four-gallon petrol tin and the
44-gallon oil drum were transformed into incinerators, grease traps, cookers, fly traps, disinfectors, shower baths, food containers, refuse receptacles and many other useful pieces of apparatus. The School played a major part in inventing, standardizing, and popularizing these useful devices. On a smaller and less formal scale, instruction in field sanitation was included in the programme of all field hygiene sections. For the purpose these units prepared demonstration grounds in which were shown full-scale models of all types of sanitary apparatus.

Full use was naturally made of all hygiene and medical officers in educating units in the importance of hygiene. Thus it was obligatory for these officers to give lectures on such subjects as malaria control and venereal disease prevention, and many others.

In the general distribution of knowledge, and in securing the adoption of uniform methods, all the usual channels were used by medical headquarters. Precise instructions and orders covering food, general sanitation, infectious disease control, such specific diseases as typhus, malaria, venereal diseases, etc., appeared at intervals both in the Middle East Standing Orders for War and in regular General Orders.

However, health achievement is so essentially dependent upon individual cooperation that modern methods of propaganda were accepted as important in educating the officers and the men in the principles of health and disease control. For this purpose use was made of the public press, pamphlets, leaflets, posters, etc. In the early stage of the campaign leaflets of a formal type were issued dealing with such subjects as fly control, typhus, malaria and venereal diseases. Later, fortunately, the illustrated "peppy" publication called "Army Illustrated Magazine" ("A.I.M.") appeared. This had a form similar to such popular magazines as "Lilliput," and "Men Only," and its presentation of material followed lines suggested by psychologists. All Army subjects were reviewed in it, such as armoured fighting vehicles, mountain warfare, combined operations, supply systems, etc. These were treated in a simple, bright, concise way and were profusely illustrated. This magazine was eagerly included in the machinery for Army health education. Articles, cartoons, quizzes, covering general health training, physical fitness, fly and mosquito control, and first aid, were published during 1943 and gained much popularity. Posters have had only a limited success, due to the spate which flowed from all Army departments. The hoardings of the Middle East were covered with brightly coloured symbols of various aspects of national savings, salvage, careful driving, health protection, etc. This profusion made it impossible "to catch the eye" with any particular poster. However, several health designs covering typhus, flies, mosquitoes, camp cleanliness, were distributed. In their development much was learned from a study of the many excellent American hygiene posters. Hygiene education films have been disappointingly poor. With the exception of the Walt Disney colour film on "Mosquitoes and Malaria," and the South African venereal diseases film "Two Brothers," the films in the Middle East were dull and often out of date. As everyone today is attuned to the extremely high technical standards of the modern entertainment cinema any less quality in educational films has a bad effect. More harm than good is done as bad presentation is subconsciously accepted as evidence of the subjects themselves being inferior. There is a distinct need for the film to be taken more seriously as a means of public education in health. Sufficient funds and professional direction are required if the attention of the public is to be caught and its education in these fields so obtained.

There is much competition, naturally, in the Army for the more useful but limited channel of education available in special C.-in-C.'s orders or letters, leaflet inclusions in the soldier's pay-book, and in such popular Army papers as "Parade." Health education managed to secure a fair share of these.

Letters were sent to senior Army commanders requesting their special support for anti-malaria and anti-V.D. measures. The conversion of senior Army and formation commanders to the importance to their operations of preventing disease and enhancing health had probably the best of all propaganda results. Such leaders soon influence their men. Several enthusiasts were enrolled amongst these exalted people—in certain cases their accretion to the cause being helped by visual demonstrations of the destructive power of disease, as for example by malaria in Sicily. Arreting facts which convinced many senior combatant officers of the
importance of health in developing an effective army were the statistics of previous campaigns as well as those of the Middle East, demonstrating that loss of man power caused by disease and defect exceeded by many times that due to battle weapons. This data was included therefore in several articles and circulars. One group which were perhaps not as successfully converted to preventive medicine and positive health as might have been possible were the medical officers themselves. An inertia in this class, or possibly a mental orientation inclined too much towards clinical practice, resulted in it not always being a very positive agent in dispersing health knowledge. Many medical officers still are too satisfied with a prescription or an incision as the beginning and end of their functions. Yet the ultimate full understanding of the power of preventive and positive medicine by the Army lies largely in the hands of its unit medical officers. The more they practise and preach its principles the fitter will be the Army.

**D. Man-management—Morale—Welfare—Rehabilitation.**

It is perhaps not yet fully appreciated either by lay or medical opinion how comprehensive Army hygiene now is. Gone are the days when it was solely pre-occupied with infectious disease, sanitation and water supplies. It now accepts responsibility for studying all influences likely to enhance or undermine the vigour, fitness, well-being and efficiency of the soldier. In a phrase, man-management is now included in the province of modern military medical services. In this section, therefore, some of these factors as affecting the individual in the Middle East will be discussed, but others, such as food, deserving fuller treatment, will be treated later.

1. Acclimatization.—The Middle East, as already mentioned, provides a variety of physical conditions. Nevertheless, its tropical features were the most prominent in considerations of the health of the troops during 1942 and 1943. However fit physically and mentally men may have been on leaving such home territories as the United Kingdom, they were not accepted as ready for immediate battle on arrival in the Middle East. Accordingly a period of acclimatization was arranged, usually four to six weeks, in the Canal Area of Egypt, before formations were passed on to any active role. This allowed physiological and, frequently, though not by design, an immunological adaptation. On the first count, the body and mind became attuned to heat, glare, dust and the harsh environment of vast desert landscapes. Secondly, in spite of care, many newly arrived units suffered from enteritis, sandfly fever and sunburn. Occurring in the settled conditions of base camps, not much harm resulted. If, however, troops had suffered these disabilities in action, serious consequences to the strategy and tactics of the forces concerned might have followed. A "salting" process occurring in base camps was, therefore, not altogether a disadvantage.

Though heat was the influence affecting most troops, many groups required care in winter. These were the large numbers from such tropical and semi-tropical environments as Central and West Africa, Southern India and Ceylon, the Islands of the Indian Ocean and the deserts of North Africa. It would have exposed such personnel to serious risks to have drafted them direct on arrival in winter to areas with almost Arctic conditions of rain, snow and cold, such as are found in the mountains and plains of the Lebanon and Syria, or even in some parts of Palestine. A medical classification was therefore given to the General Staff as to the regions in which these tropical troops could be employed. This took into account not only their tropical or semi-tropical origins but also whether such troops came from rural and primitive conditions or from sophisticated urbanized communities. That rural people take less kindly to changes of social circumstances and, if from the tropics, are usually chronically-infected with such diseases as malaria, hookworm and schistosomiasis, were factors not overlooked. The classification was roughly as follows:—

(a) Indians from hilly provinces, Syrians and Lebanese could be employed in the same areas as European troops.

(b) Basutos, as they came from a plateau with a cold winter, after a winter of acclimatization in the Middle East, could also be employed anywhere, but should always be kept under medical observation.
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(c) Mauritian and Seychellois after winter acclimatization could be utilized in any location.

d) Africans from East Africa, the High Commission Territories, the Congo and West Africa, and Indians from the tropical areas should have careful acclimatization in Egypt or the Plains of Palestine before exposure to winter in Europe or in Syria. In addition, these troops were not to be used in areas with a prolonged winter of rain, snow and frost.

That this medical concern in acclimatization was justified had proof in summer and winter incidents. The crisis of the retreat to El Alamein in the middle of the summer of 1942 brought reinforcements rushing to the Middle East. The “Queen Mary” arrived at Suez jammed with troops. Their disembarkation and move to transit camps took place in extremely hot trying conditions resulting in a large number of heat-stroke cases. Then in the winter of 1943 several Pioneer Companies of West Africans were employed in wet winter conditions on port duties at Benghazi and Tobruk. There was a consequent high incidence of lobar pneumonia, but the exhibition of sulphonamides prevented fatalities. With the exception of these two minor incidents, the vast bulk of the force during 1942 and 1943 had an uneventful phase of acclimatization. This adaptation, assisted by the measures to be described in the next two sections, gave protection in a high degree from the deleterious summer and winter physical effects.

(2) Heat and Light Effects.—Heat was most dangerous when troops were newly arrived in the Middle East. The journey up the Red Sea followed by a slow tedious disembarkation into landing barges and a journey of some distance to the camping areas strained new troops to breaking point on occasions, as in the case of the S.S. “Queen Mary” already referred to. Liners of the North Atlantic route, such as this, were particularly unsuitable for use in the tropics, and so aggravated the hot conditions of the Red Sea. That overcrowding of troopships, owing to the serious shipping state, could not be avoided, was recognized. However, to minimize heat effects, every endeavour was made to increase ventilation, to allow the full use of decks, to reduce physical exertion on day of landing, to provide full drinking water supplies and to arrange for the early detection and treatment of symptoms of heat exhaustion, both on the ship and at the landing stage.

In so far as general service in the Middle East during 1942 and 1943 was concerned, no special heat problem arose. General instructions were issued to all units, giving in simple language, the part played by high air temperature, high humidity and still air in causing a strain on the body-cooling mechanism. Attention was directed to the need for avoiding the sun as far as possible in very hot areas in the heat of the day and for wearing head-dress. Strenuous work was, during this period, to be reduced to essentials. Regular bathing and the wearing of loose open-necked clothing were recommended. Generous amounts of drinking water to which salt was added in the proportion of ½ teaspoonful to 1 pint of water were to be taken. Allowance was also made in the ration scale for the amount of salt per man per day to be raised in summer from ¼ to ½ ounce in areas where heat was excessive. Anxiety as to heat exhaustion occurring in crews of armoured vehicles was not unnatural. Surprisingly enough this was not a major hazard. The absence of cases of heat stroke or heat exhaustion in tank crews from the summer battles of the Western Desert was practical proof of the experimental work done on the subject by No. 1 Medical Research Section. This had shown that, though katathermometer readings reached alarming heights inside a stationary tank in the open, the starting of the engine, thus operating the tank’s ventilating system, drew sufficient air through the vehicle to maintain an adequate cooling action on the bodies of the crew. That armoured vehicles would not provide problems in other conditions, say, in jungle warfare, was not to be deduced from Middle East experience. It was the low relative humidity of the desert air which protected the body’s cooling mechanism. Other problems of heat arose in workshops, factories and such installations as base laundries. During the heat waves (“khamseens”) of early summer, conditions were often almost intolerable, especially at night under “black-out” restrictions. Only general measures of improving ventilation, providing ample drinking water, etc., could be applied in these instances. Air-conditioning would gladly have been used if the machinery had been available, but only one or two plants
could be obtained. These were installed in such essential premises as the G.H.Q. telephone exchange, and the hospital at Massawa, probably the hottest station in the Middle East. The excessive sunlight as judged by Western European standards produced a demand for general issues of tinted spectacles. This was resisted on the principle that the average human eye is capable of an enormous range of adaptation and could meet most conditions of the Middle East. Naturally such units as A.A. with a special need to overcome direct glare were given tinted eye-shields. Sunlight almost certainly seemed a strong aetiological factor in the causation of desert sores.

(3) Cold.—The planning for the possibility of operations in the Caucasus or the Turkish plateau when the Germans were sweeping on to the Caspian in 1942, led to the examination of clothing, rations, frost bite, "trench" feet, and such matters in relation to cold climates. A special cold climate ration scale was prepared providing over 5,000 calories per man per day. Stocks of warm clothing, including "sou' westers," leather jerkins, gum boots, etc., were gathered. Orders were issued as to measures to combat frost-bite and "trench" feet. The use of foot soap and foot powder was laid down in these orders and the necessary quantities were stored. These preparations became unnecessary with the Stalingrad defeat of the enemy and his failure to make Turkey a battleground.

Though no extreme Arctic conditions were met by the Middle East Force, it had to deal with severe winters in the Lebanon. As quickly as circumstances allowed, troops in these areas were moved from tents into stone, brick or other type of hut, five blankets per man were allowed, and such extra items of clothing as woollen vests, extra pairs of boots, leather jerkins and cap comforters were issued. The various local medical authorities were also warned of the susceptibility of primitive non-immune troops from tropical areas to respiratory conditions, and of the need for special supervision of their food, clothing and housing. As mentioned above, West Africans in Cyrenaica experienced an outbreak of pneumonia in the winter of 1943. Generally, though, cold caused no serious impairment of health or efficiency.

(4) Clothing.—Soldiers' clothing has many aspects which concern his health and protection from harmful agencies. The troops of the Middle East had summer and winter outfits. That of summer consisted initially of a drill open-necked shirt, shorts and slacks, while in winter the dress was the well-known battle-dress. Head-dress early in 1942 consisted of either the topee or forage cap. Various modifications were made during the two years. A steady medical campaign for the abolition of shorts had only a partial success, when late in 1943 the ratio of 2 pairs of shorts to 1 pair of slacks was reversed. The use of slacks was made obligatory only in operational areas. The medical case in favour of slacks and long-sleeved shirts only was based on the following arguments:

(i) The larger the skin area covered the greater the protection against insects including such vectors of disease as the anopheline mosquito and the sandfly.

(ii) Exposed skin showed a much higher incidence of the so-called desert sore—the vague heterogeneous group of skin ulcerations arising out of the combination of such agencies as slight skin injury, fly contact, dirt and sand impregnation, and sunlight.

(iii) Burns always affected exposed areas such as face, hands, forearms and knees most severely. Ordinary clothing was found in tank fires to afford a high degree of protection against flash burns.

(iv) If gas warfare developed, the more skin covered by clothing the better.

As the war progressed, sources of clothing changed and materials had to be examined before accepting new contracts. Thus the summer issue was changed to include bush shirts. Both the design and material of these, in early issues, were objectionable. The soldier disliked the untidy shapelessness of this garment and medically its loose thin texture was criticised, as it allowed mosquitoes to pierce through to the skin. Head-dress underwent changes too. The topee except for small specially exposed groups in the hotter areas was abandoned without any harmful sequelae. Footwear gave no trouble except in locally enlisted A.T.S. girls. Here racial foot characteristics made the usual English ranges of shoes too limited. By increasing types and allowing made-to-measure shoes in certain cases this difficulty was
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overcome. The Brinje Vest, i.e. a vest made of string, was considered in the Middle East as a protective both against excessive heat and cold, but supplies were not received. Generally, the very extreme climatic conditions for which the Brinje Vest is especially useful are only occasionally met in this region.

(5) Equipment.—A large proportion of equipment used was of standardized British Army types. Modifications were required in but few instances to meet Middle East conditions. The chief medical interest was associated, therefore, in locally-made equipment. Local production eventually became an important Middle East function, and many matters were referred for technical medical advice and opinion. Water containers, which were the solution of the problem of supplying rapidly advancing troops in the desert, were obtained by the use of 2-gallon and 4-gallon petrol tins and initially also of the captured 2-gallon jerricans. In the case of the petrol tins, confirmation had to be obtained of their freedom from soluble lead. Later when petrol came to be transported in terneplate, i.e. lead plated sheets, containers, special attention was drawn to the dangers of using these for storing food or water or for converting them into cooking utensils. Local equipment such as food plates, cutlery, hair and shaving brushes, blankets, tentage, camp furniture, required medical opinion as to its suitability or influence on the health and welfare of the troops. Wherever possible, trials of new or modified equipment were made. In this way useful data was collected on the design of helmets, web equipment, and anti-mosquito clothing.

(6) Morale and Welfare.—In the Army in this war, "hygiene" has accepted a watching brief over the morale and welfare of the troops. It is an extremely large and important subject deserving a report to itself, but here only its salient features and certain illustrative examples can be given from Middle East experience. Fundamental to morale and welfare are freedom from disease, good varied food, satisfactory clothing and housing. These general aspects are described in separate sections of this account. However, over and above this minimum, much was done with the special object of enhancing morale. In the sphere of amenities, hygiene authorities added their support to the demand for sport and recreation for the troops. Swimming was stimulated. Many units had the benefit of proximity to the Mediterranean. For others inland baths were constructed. Chlorination of these was undertaken under the supervision of local hygiene personnel. Sports grounds were developed as quickly as possible. Football had the widest appeal, being played by Europeans, Africans and Asiatics. Apart from amenities provided by voluntary agencies, canteens, rest huts, etc., were an official feature appearing early in all permanent or semi-permanent camps. Many of these competed in originality of layout, brightness of decoration, and in comfort and cosiness with any peacetime restaurant or "local." In order to maintain scrupulous cleanliness of kitchens, dining halls, ablutions, etc., all such institutions received regular scrutiny from local hygiene officers. In the leave camps that were established in Tripolitania, Egypt, Palestine and Syria, every care, too, was taken to enable the residents to escape from the Army atmosphere. Apart from such physical provision, facilities for mental relaxation were developed as time went on. There were mobile cinemas, libraries and concert parties, which, reaching forward areas and remote isolated detachments, were a direct fillip to morale.

In the normal course of their duties, hygiene officers took note of any such factors as delay in receiving home mail, lack of equipment, food, cooking apparatus, etc. Such defects were then brought to the notice of the appropriate authorities.

(7) Rehabilitation and Optimum Use of Man Power.—Where every man-hour is important, the responsibility of the Army hygiene authorities did not stop at keeping personnel fit and free from disease. It extended its functions to reducing to a minimum the period after hospital discharge before a soldier returned to duty and, secondly, to placing every man, especially those not fully fit, in the most productive employment. In regard to the first aspect all long-term patients from hospitals went to convalescent depots. These institutions are not places where a soldier follows an aimless, lazy life for a few days or weeks. Each patient is guided into a carefully planned existence of feeding, occupation, exercise and, in a few instances, special medical treatment, designed to restore his health, vigour, and function as
A. E. Richmond and H. S. Gear

The Middle East was fortunately possessed of several excellent Convalescent Depots caring for various categories of troops. Situated mostly in excellent seaside spots, an ideal environment was provided. Each had the advice, too, of a specialist in physical medicine and a team of physical instructors and masseurs to carry out remedial exercise, restoration of muscular and joint function, hardening of physique, etc. The physical hardening process continued when the ex-patient, leaving the convalescent depot, passed to his base depot awaiting return to an active useful life. The Senior Medical Officers of these depots, advised by the staff of physical medical experts and psychologists, ensured that each soldier was brought to the highest pitch of fitness, and received any final medical treatment or such apparatus as dentures, glasses, special boots, etc. In addition, any soldier examined here by a medical board and classified as lower than A.I came under the system distributing personnel into categories of employment most suited to their particular standards of fitness.

The Army possesses a vast system for the continual checking of fitness of all those classified, at some time or another, because of eye, foot, muscular, dental or general medical condition, as temporarily below par. In the Middle East all men in medical categories B and lower were reviewed regularly. Thus it was possible to comb out fit men from base and L. of C. jobs for meeting the insatiable demand of operational units. Medical advice was necessary also in utilizing the regrettably large group of personnel with permanent physical or mental inadequacies. The medical categorization adopted for the British Army as a whole required certain sub-classifications to meet Middle East conditions. Thus a class of so-called "Restricted Posting" was introduced, composed of individuals whose defects necessitated their use in limited kinds of work only. Specialists and boards handling these cases indicated in their findings the work or employment considered suitable. The personnel authorities then made postings accordingly.

In this section covering man power, some slight indication has been given of how Army hygiene in this war, as exemplified by Middle East practice, has taken a direct interest in enhancing the efficiency of the individual and, once having secured the optimum, has directed him into that occupation where he is likely to make the best of his available physical and mental capacity.

E. Water Supplies.

The excellence of the supplies developed and maintained by the Engineers in Base and L. of C. areas, and the adequacy of equipment for purifying and transporting water to troops during the various moves in the Libyan and Tripolitanian deserts, relieved considerably the anxiety of the medical authorities in connexion with water. In Egypt, a most comprehensive system was quickly extended along the vast camps up and down the Suez Canal, and along the desert area to the North of the Sweet Water Canal. The other noteworthy engineering feat was the coastal military supply, by which water was carried across miles of desert from Alexandria for the Eighth Army in its various phases of advance and retreat during 1942 and 1943. This vast system was a monument to the energy and capacity of the Engineers. At suitable points along the Sweet Water Canal water filtration and purification units were erected. Into these, water from the Canal was pumped. Passing through rapid sand filters after alum treatment, sediment and gross impurities were removed. Chloronomes then discharged chlorine into the emerging flow sufficient to raise the free concentration of the gas to 0.2 part per million. An extensive reticulation system with various booster pumps and holding reservoirs conveyed the water over the enormous area of the Army camps in the region of the Canals. In Cairo, water was obtained from the civilian supply. Thus for base units in Egypt, medical supervision was reduced to a minimum. Throughout the two years no breakdown in this system occurred, and so literally hundreds of thousands of men received drinking, cooking and ablutionary supplies in a satisfactory manner.

The Eighth Army supplies called for more medical concern. As the distance westward into the desert from Alexandria increased, so sweet water in adequate quantities became...
more difficult to provide. The pipe-line was pushed after the advancing elements as rapidly as possible on both occasions that the enemy was pressed back into Libya. In spite of the size of this system the quantity of water could not be raised above approximately one and a half gallons per man per day. To relieve the pipe-line therefore, and to seek additional means for increasing the supply, every local well and other source was investigated and, if at all acceptable, exploited to the maximum. Ancient Roman subterranean aqueducts at places like Mersa Matruh and other coastal sites were opened and made to contribute. For these isolated supplies from wells and aqueducts much hygiene supervision was demanded. Initially the purity, salinity and other factors were assessed, and means of purification defined. These almost invariably were superchlorination using Army water sterilizing powder (bleaching powder) followed by de-tasting with sodium thiosulphate. At many sources units had to rely on their own treatment of water. Here a hygiene assistant gave instructions as to the proportion of the sterilizing powder to be added. This practice was inefficient in that the addition of the sterilizing agent to small variable collections of water was difficult to regulate. On seeking a solution to this problem the Middle East School of Hygiene evolved a chlorine dosing tap which will be mentioned later.

There were two annoying aspects of the water problem in the Eighth Army which concerned hygiene officers. The first was the excessive salinity of desert wells. Many such supplies gave readings of over 200 parts per 100,000. It was surprising, therefore, that many tolerated water with up to 250 parts for even weeks without untoward effects. However, excessive salinity was reduced wherever possible by mixing such waters with sweeter supplies from other wells or with water transported from the pipe-line. The second problem was that of water sources damaged by the retreating enemy. Apart from physical destruction of wells and their equipment, the enemy polluted them with human and animal bodies, diesel oil, kerosene and filth of all descriptions. In addition to the clearance of gross materials these supplies were rendered fit by continuous pumping and sterilization with excess of bleaching powder. No instance of deliberate specific poisoning by the enemy using arsenic or other agents was discovered in the desert campaigns.

In the other areas of the Middle East, such as Palestine and Syria, the supply of water involved little for the medical authorities other than orthodox supervision and testing. In most areas local civilian supplies met military needs. Where the Army was not satisfied with civilian standards it provided its own safeguards in such form as local chlorination before distribution to units. Civilian supplies used by the military frequently owed much to Army engineers for augmentation and for supplies of apparatus and water chemicals. In Asmara, in Eritrea, for instance, a previously inadequate and uncertain water supply had its permanence ensured by several new reservoirs built by Army engineers.

The mobility of some phases of modern warfare has evoked a miscellany of water apparatus for use in the field. From the simple water-cart there has now been evolved a series of mobile water purification plants. Units such as battalions were self-contained when possessed of the standard Army water-truck. Equipped with the modern metal filters of the Stellar or Meta type such trucks were capable of supplying up to 200 gallons at a filling. Each truck is supplied with a testing box and the necessary chemicals of kieselguhr, water sterilizing powder and taste remover tablets. A dangerous tendency of units when at the base, and therefore drawing on command supplies, was to allow the maintenance of their water-trucks and the training of personnel in the use of such apparatus to lapse. Early in 1942 inspections showed that many units, if suddenly thrown into action, and therefore possibly on to their own resources for securing water, would have been seriously handicapped through their water-trucks being out of working order and with no one trained to deal with water apparatus. This unhappy discovery led to all water apparatus being brought into good repair and a direction to all medical officers to discharge their responsibility of having their units prepared with efficient apparatus and trained personnel. Another item of water apparatus which was available, but in this particular theatre not much used, was a portable filtering apparatus consisting of a standard metal filter and hand-pump mounted on a tripod. A few
of these units were carried by the Eighth Army and were available for supplying small detachments as they could deliver water at the rate of 100 gallons per hour. For the mass handling of water supply in the field the Engineers fortunately possessed several large units capable of handling quantities of water up to 3,000 gallons per hour. One such type was mounted as a trailer but others were self-contained mobile units. In these large-scale water purifiers filtration was done through a series of metal filters in the usual way but purification depended not on chlorination but on chloramination.

In discussing the difficulties of dealing with small quantities of water at isolated water points, it was mentioned that the M.E. School of Hygiene had evolved a simple method of regulating chlorination. This consisted of an ebonite dosing tap attached to a suitable receptacle at the water point. In this receptacle was placed water sterilizing fluid made up to the necessary concentration. By turning the water tap an exact quantity of water sterilizing fluid was trapped in the tap and then discharged into the water container to be treated. Depending on the size of the water container one or more turns of the ebonite tap were made to provide sufficient water sterilizing fluid to purify the contents.

One further aspect of water apparatus requires mention. This refers to the colossal scale on which water containers improvised from petrol cans, “Jerricans” and “Amerricans,” were used to carry water forward during the advances of the Eighth Army in the Western Desert. As petrol containers were the source of the majority it was necessary for the medical authorities to ensure that no harmful contamination would arise by carrying water in them. It was known that one type of these containers was made from terneplate. Also the majority of containers had been used to transport petrol of a high octane. Various experiments were therefore carried out to determine whether water in such containers would take up lead in dangerous quantities. The terneplate containers were rejected in toto as, being lead covered, giving off dangerous quantities of lead in solution. The other containers, however, unless badly soldered, were accepted for water purposes, provided they had been thoroughly washed out so as to remove all traces of high octane petrol. Bituminizing the interiors was later adopted. It was fortunate that at no time was there any anxiety about stocks of chemicals required for the various water supplies. Chlorine gas, water sterilizing powder, alum, kieselguhr and de-tasting tablets were always available in quantity. In addition, large stocks were held of Halazone tablets for use by any formation having to depend on its water-bottles for collection and purification. On behalf of the War Office the M.E. carried out several series of tests of the new Halazone tablet and confirmed that it retained its strength of liberating up to 8 parts per million of available chlorine after storage for two to three months in the M.E.

That the water supply to the M.E. Forces using the above methods was not harmful is demonstrated by the fact that no outbreak of water-borne disease occurred. However, on one occasion, the Army was concerned in protecting itself against water-borne enteric in Malta in May, June and July, 1943. This was an extremely interesting example of water-borne disease. Enemy bombing had fractured a water main, a fact, however, which was not known at the time. No harm resulted until some months later when, in the process of clearing an aerodrome, a “bulldozer” broke a sewer alongside the previously damaged water main. This allowed crude sewage to enter one of the principal water mains supplying certain villages and a section of Valetta. From this combination of accidents there resulted an exceedingly severe civilian outbreak of typhoid with several hundreds of cases. With the exception of a few cases of Maltese soldiers the Army escaped. This remarkable fact is attributed not only to the protection given by T.A.B. vaccine but also to the arrangements made, immediately the contamination of the supply was known, to purify at distribution the water used by the Army. This, with direct control and discipline, was more easily and expeditiously done in the Army than in the civilian population.

F. Food.

(1). General Policy.—To achieve proper feeding of an army is one of the most complex problems perplexing military administrators. The basic difficulties were increased many
times in the case of the Middle East Force, especially in the years 1942 and 1943. All those factors of race, climate, religion, etc., discussed in the first section of this paper, influenced the subject of food. But there were others. As shipping became the crucial consideration in the general war economy in 1942, the method of stocking the Middle East larder had to be reviewed. Then, in addition, the Japanese successes in capturing Malaya and the Dutch East Indies, and their direct threat to India and Australia, shook the whole supply system of the Middle East. Not only had imported supplies in general to be reduced drastically, but India and Australia in the dark early months of 1942 had to be discounted to a large extent as a continuing source of such important supplies as rice, flour, meat, oil and canned goods.

Though it was the policy of the Middle East Command from the outset to become as self-supporting as possible, the events of 1942 lent extreme urgency to the process. The quantities of flour, frozen meat, oatmeal, rice and the large range of canned goods, which the Army previously had obtained from overseas, had to be replaced by local products. This was not easy, for the whole Middle East agricultural and industrial production, already taxed by civilian demands, was also denied access to normal peacetime supplies. It was necessary, therefore, as a first step, to expand existing and create new local sources. This in turn called for more agricultural seed and machinery, industrial plant, and such items as tin-plate, nearly all of which had to come from overseas. However, through the stimulus and co-ordination provided by the Middle East Supply Centre under the Minister of State, Mr. Casey, this immense and complicated task was accomplished. Thus, with but little friction or dislocation, the Army adapted itself to a new system of food supplies, where imported products of meat, oil, cereals and canned goods were replaced with similar or allied products coaxed out of expanding or new local ventures. Though much manipulation of types of foodstuff was demanded, and a slight reduction in quantities was unavoidable, the soldier did not go hungry, nor did his health in any way suffer.

The complexity of Army food problems led to the creation of the Middle East Ration Committee. Consisting of representatives from the Supply, Medical, Catering and Financial Services, it handled the continuous stream of questions on ration scales, food preparation methods, substitution of imported items by local products, seasonal changes of supply, etc. Charged with adapting the Army feeding to the change in sources of supply following strategical developments all over the world, the Ration Committee bore the heavy responsibility of reducing ration scales and introducing new and frequently untried local foods to replace those unobtainable from overseas. With the constant change in the composition and function of the Middle East Forces, the fluctuation in the fortunes of its campaigns, the varying supply situation and the shifting scene of operations from the desert to Sicily and the Mediterranean Islands, the work of the Committee never reached finality. The measure of its success is not to be found solely in the health and vigour of the troops, but also in the fact that the soldier himself, with negligible exceptions, did not grouse.

(2) Some Medical Factors regarding Food.—That the modern Army administrator grasps the importance of the medical aspects of feeding troops has been amply shown in the Middle East. In the creation of the various ration scales fundamental to the whole system and organization of obtaining, distributing and consuming food, the medical opinion was supreme. If a certain type or a fixed quantity of food was requested by the medical representatives, these demands were met. Only complete impossibility of getting any item was advanced by the supply authorities for not adopting any given medical recommendation.

In the construction of ration scales, an early difficulty lay in the lack of authoritative calorific, vitamin and salt values for the majority of foods. In 1943, a useful work was therefore performed by the War Office nutrition advisers in issuing a comprehensive table of generally accepted values for all the commoner food items. It became possible then to determine the value of the scales with considerably more confidence. These scales in number and variety are scarcely credible. During 1942 and 1943, over thirty-five scales were in use. They, as will have been deduced from the remarks above on the changing supply situation, rarely remained fixed for long. A ceaseless labour therefore went in checking their calorific
and vitamin values, quite apart from the stupendous task the fluctuation of such a large number of scales imposed on the supply services. It is only possible to give here some of the salient features of the medical aspects of the Army feeding in the two years. The scale which was used by the majority of troops, and which it was the policy of the Ration Committee to apply to as many categories as possible, was the Middle East Field Service Ration Scale. Originally, it had a value of 4,000 calories per man per day, but the "tightening of the belt," referred to above, brought it down to 3,700 for a short time in 1942. Nevertheless, it was soon increased to an approximate value of 3,800 in 1943. Its vitamin value when fresh items were supplied was, on a conservative basis:—

<table>
<thead>
<tr>
<th>Vitamin</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A</td>
<td>4,000 International Units</td>
</tr>
<tr>
<td>Vitamin B₁</td>
<td>550 International Units</td>
</tr>
<tr>
<td>Vitamin B₂</td>
<td>1·5 mgm.</td>
</tr>
<tr>
<td>Nicotinic acid</td>
<td>24 mgm.</td>
</tr>
<tr>
<td>Ascorbic acid</td>
<td>75 mgm.</td>
</tr>
</tbody>
</table>

Occasionally, on active operations or in areas where fresh supplies were difficult to get, certain so-called dry equivalents were issued. These were biscuits in lieu of bread, pressed meat, tinned fruit, tinned milk and tinned vegetables. Under such conditions, accessory quantities of vitamins were supplied. At first these took the form of marmite or yeast tablets and ascorbic acid tablets, but later a compound vitamin tablet containing:—

<table>
<thead>
<tr>
<th>Vitamin</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin B₁</td>
<td>400 International Units</td>
</tr>
<tr>
<td>Vitamin B₂</td>
<td>1 mgm.</td>
</tr>
<tr>
<td>Nicotinic acid</td>
<td>10 mgm.</td>
</tr>
<tr>
<td>Ascorbic acid</td>
<td>25 mgm.</td>
</tr>
</tbody>
</table>

was available in large quantities. In the scale, proteins were provided in the form mainly of meat, bacon, fish, eggs, cheese and milk. Fat was not made prominent as local conditions obviously did not favour a high fatty diet. The chief fat item was margarine, but cooking oil was also provided. Bread, flour, oatmeal, potatoes and pulses were the main sources of carbohydrates. It was the austerity policy of 1942 and 1943 which reduced the quantity of frozen meat (imported from Australia), potatoes, oatmeal, rice and tinned food. Compensation was obtained by increasing bread, local fresh meat and cooking oil, as well as introducing ground nuts into the scale. The Field Service Scale was gradually adopted by the majority of groups, including the U.K., Dominion, Free French, Maltese, Mauritian, Cypriot, Greek, Polish and Yugoslav troops. Contrary to expectation, little difficulty was experienced by these troops in changing over to a scale basically designed for the taste of British troops. However, there were many other groups whose religious or racial dietetic customs could not be ignored. Indians were provided with a scale including atta as its bulk item, and such items as dhalls, ghi and Indian condiments. Africans from the High Commission Territories of South Africa and from East and West Africa were eventually placed on a single African scale allowing for the special desire for the bulkiness of mealie meal and bread. Ground nuts were a useful item in these scales in giving high calorific and vitamin B values. Sudanese, Libyans and Arabs were given a scale with a high content of local bread and cooking oil.

Incompatibilities were involved in producing the various so-called "Battle Assault" and special operational ration scales. Raiding and reconnaissance parties in the desert had to travel light and could not get water; assault troops in the opening stages of battles had to be self-contained for several days until the normal supply lines could be established; parachute troops could not expect supplies to get through to them for several days; and finally, tank crews in battle could not always depend on getting back to supply areas. These special ration scales created conflicting requirements. The need for mobility, freedom for fighting, the least bulk and weight in transport, for non-perishable readily-prepared foods on the one hand, clashed with providing high calorific, palatable, sustaining and refreshing meals. Modern food developments eased considerably the problem of constructing ration scales which had high calorific value, small weight and bulk, were non-perishable, and needed little or no cooking. Nevertheless, field experience has corrected the view that troops will subsist for any length of time on a purely concentrated artificial "tablet" diet. In time, various
operational scales were evolved. The "Battle Ration" used, for example, by the Eighth Army in its attack at El Alamein, had a caloric value of 3,100 and, besides the basic items of biscuits and pressed meat, included cheese, jam, tinned milk, vegetables and fish, and the ingredients for tea. The extremely efficient follow-up of supplies behind the advance, however, saved the troops from any long spells on the "Battle Ration." The limit of ten days laid down was never exceeded. Another scale of the type which met rather peculiar conditions was that used by the Commandos. In it, sugar, ground nuts, cheese, dried fruit, raisins, chocolate and tinned fish were very acceptable items, and proved satisfactory in many raids.

In the Sicilian campaign occurred the first opportunity of trying out the pack type of ration. A composite 14-man pack ration had been prepared by the War Office to meet the needs of 14 men for one day, or 1 man for fourteen days. It contained a variety of items, all canned, which gave an energy value of 3,600 calories per man per day. There were dishes of sausage, steak and kidney puddings, meat and vegetables, fish and cheese. Experience in the Middle East of these various operational rations has shown the value of such items as added fruits, ground nuts, boiled sweets, chocolate and tinned fish. These items are palatable for troops living strenuous, exciting lives for a few days, they are of high caloric value, and easily carried. No cooking is required. Ingredients for a hot drink, tea in the case of British troops, should always be included in scales such as these.

In all routine scales special care was taken to ensure adequate vitamin values. Wherever possible, this was done through the inclusion of sufficient quantities of "protective foods"—meat, milk, fruit and vegetables. The vitamin A content was maintained by using fortified margarine, cheese, milk, and fixing a minimum quantity of fresh or dried carrots and of first-class green types in the vegetable issue. Dried apricots were also specified in the dried-fruit issue. Red palm oil, which could only be got in small quantities, was added to African and Prisoners of War scales as an invaluable means of enhancing vitamin A values. The vitamin B series were the most difficult to provide. For this purpose, a proportion of either wholemeal flour or imported fortified B, Canadian flour in the Middle East flour mixture was fixed. Oatmeal, meat, milk, pulses and potatoes were depended upon, too, as sources of the B series. The ground nut was a very welcome Middle East dietetic item as it had not inconsiderable quantities of vitamin B₁, riboflavin and nicotinic acid. The local market was accordingly exploited to its limit and ground nuts added to most scales. Vitamin C did not create any difficulties. Usually, fresh fruit and vegetables were available. The supply authorities, co-operating fully, enabled local contracts to be drawn up so that fresh vegetables of high vitamin A and C content were always selected in preference to such types as marrows, squashes, etc.

Both to add variety to the rations and to balance their vitamin content, such locally available items as eggs, fresh and smoked fish, kidney and liver were used wherever possible. When ordinary methods of supplying vitamins failed, the combined vitamin tablet mentioned above was a "stand-by" to ensure the adequacy of rations. Fortunately in the Middle East there was rarely any difficulty in maintaining satisfactory fresh supplies.

(3) The Distribution and Preparation of Food.—Experience of supervising the nutrition of an army has emphasized that having a properly balanced ration scale with sufficient protein, carbohydrate, fat, mineral salts and vitamins is but half the story. In the Middle East, medical supervision has been as much concerned in other aspects of nutrition as in calculating caloric and vitamin values. These have included defining conditions for the preservation of the value of fresh items, and for cooking and preparing food to protect its nutritional and hygienic qualities. It is of little use giving an Army unit satisfactory and sufficient quantities of meat, bread, flour, vegetables, fruit, etc., if it is incapable of transforming these into palatable, nutritious dishes.

Actually getting the Army to safeguard foodstuffs in transport from depots to units and to cook properly was a very thorny problem indeed. Fresh supplies suffer rapid deterioration in the field, intensified in the conditions of heat, dust and flies typical of a Middle East summer. A gigantic civilian army too, can scarcely be supplied in a few months with sufficient trained
conscientious cooks—cooks, too, who have to prepare food with few of the devices and apparatus available in an ordinary peace-time modern kitchen.

These various problems were tackled vigorously and not without success through the cooperation of supply, medical and catering authorities. The supply authorities for their part built up a system of clean, efficient depots, refrigerator vehicles and stores, mobile bakeries and butcheries, which brought food in a clean, fresh, wholesome condition right up to the doorstep of field units. Units, by education, example and occasionally coercion, were brought to a high standard in methods of collecting food from depots, transporting it forward and storing it in unit areas. Improvised food containers to carry and store fresh meat, vegetables, cereals, etc., were soon in the possession of most. Kitchens and food preparation quarters were eventually accorded proper hygiene respect and rigorous standards of cleanliness and orderliness applied.

In demonstrating the importance of the kitchen and the cooks in the economy of the Army, immense help has been received in this war from the Army Catering Corps. Their Schools of Cookery and their system of local catering advisers and inspectors produced in a very brief time a long-needed improvement in the type of man selected as cook, in his training and in his work. The Corps undertook, too, continual experiments and research with excellent results in the way of making field kitchens, ovens and other apparatus, and in methods of dealing with such items as rice, "bully," ground nuts, etc., so as to make them palatable to troops previously unacclimated to these foods. In all its methods, the Corps gave full emphasis to medical recommendations for the preservation of vitamins in the storage and preparation of food supplies and to cleanliness in handling food.

The peculiar food problems of the desert and mobile armoured-vehicle fighting, resulting in wide dispersal of vehicles, units and men, have been treated in a previous article (Gear), so need no further reference now.

The feeding of patients in hospital had many exasperating features. The wide dispersal of wards, frequently over sandy desert country, made the transport of food from central kitchens a major problem. No completely suitable hot trolley or container could be devised. Then hospital kitchens, as all others, had to depend on oil as a heating medium. Lack of engineering supplies and personnel and the complicated control of oil burners left a largely unsolved problem of dealing with soot in these large-scale kitchens. However, by the end of 1943, the high place of cooks and kitchens in helping the Army to be fit and vigorous had been secured, and the handling of food at all stages from the depot to the mouths of the soldiers was efficient and cleanly. Food waste was so reduced that even an Oriental swill collector found little to extract from disposal receptacles.

(4) Diseases associated with Food.—Food deficiency diseases were largely conspicuous by their absence. This was a mark of the success achieved in constructing balanced ration scales and in getting food supplies properly distributed and prepared for the forces scattered throughout the Middle East. The only group in which avitaminosis occurred was that of Libyan Prisoners of War. Through certain circumstances, outside local control, their ration scale had to be changed. A theoretical sufficiency of riboflavin was allowed in the diet but, in practice, owing to a mixture of factors, including the racial method of food preparation, a deficiency apparently occurred. These resulted in widespread minor manifestations of arboflavinosis, especially in the form of stomatitis and glossitis. The careful medical supervision continuously maintained soon detected the incipient condition. Treatment with milk and yeast produced early cure. Except for quite abnormal isolated instances, scurvy, pellagra and beri-beri did not occur anywhere in the Middle East Forces. As the present day medical practitioner is conscious almost to a fault of the possibility of food deficiency, it can be accepted that any cases in the Middle East would have been detected. Several surveys by medical heads of hospital divisions and by the Consultant Physician also failed to discover any food-deficiency disease. On the contrary, the men of the Middle East Forces were amazingly fit. They filled out, put on weight, showed bronzed glowing skins and indeed exhibited all the signs of well-nourished healthy beings.
Food poisoning inevitably made some appearances. Typically, the cause in most cases could only be surmised on circumstantial evidence. In most cases, the evidence led back to rehashed food kept overnight. The comprehensive system of food inspection in depots and in the field served as an efficient screen against damaged food getting into kitchens. Intrinsically sound though the Army food was proved to be, it was nevertheless, in spite of all precautions, on occasions a vehicle of excremental disease, e.g. dysentery, enteritis and, to a smaller degree, typhoid. As will be elaborated in a later section, food, water and fly-borne disease was a major cause of sickness. Yet in the Middle East campaigns, owing both to general sanitary improvement, and to the better protection of food, these diseases took much less toll than in previous wars.

G. Care of the Physical Environment.

In the section above on man-management, the efforts to provide physiological adaptation of the soldier to his new environment are broadly described. The attempts to modify and control some at least of the components of this Oriental and sub-tropical setting form the substance of the present section.

(1) Siting of Military Communities.—The three insects, fly, mosquito, and sandfly, had much to do with the placing of military communities, whether in camp, barrack or workshop. In having the large base, transit and L. of C. camps situated, for example, in desert areas such as Quassasin, Tahag and Amiriya in Egypt, and in country districts in other territories, the main uncontrollable sources of fly breeding, viz. native villages and towns, were largely avoided. However, the segregation of military populations as far as possible had other objects. It reduced contact with vendors of doubtful food and drink, and with such infections as typhus, smallpox, plague and venereal disease. These diseases in the military in the Middle East had a close correlation with civil urban communities, e.g. plague in Suez and Port Said, typhus and smallpox in Cairo, Alexandria and the Canal ports.

To revert to the influence of insects, it is not unexpected to note the major role played by the anopheline mosquito. As an initial guide to the staff, the whole Middle East was surveyed by the various malaria field laboratories. This showed areas broadly classified as highly malarious, malarious, and non-malarious. Wherever possible, military installations were naturally limited to the non-malarious regions. If for some strategic or operational need this could not be so, local malaria surveys secured the best site within the selected area and indicated the measures required to reduce the risk of infection. Amazing though it may be, the inclusion of medical representatives in discussions on such fundamental hygiene problems as camp siting was by no means accepted as automatic by Army staffs in the early months. However, steady propaganda eventually achieved this essential measure. One of the mental fixations that had to be removed was that the hazards of an area were static. Thus, Staff officers were inclined to think if they were supplied with a map showing areas classified broadly as highly malarious, malarious, and non-malarious, that these constituted a permanent fixed guide for all time in the future. They only slowly came to realize the peculiar local features of malaria, for example, and its characteristic fluctuations due to season, weather conditions, etc.

The sandfly produced some serious geographical problems. “Unsalted” groups suffered exceedingly when quartered in sandfly areas. Such an important institution as the Officers’ Training Unit conducting intensive short term courses was at one time almost crippled by sandfly fever. Its transfer to a new site was seriously considered, but vigorous local control measures fortunately were sufficiently successful to avoid this. The coastal plains of Palestine and Syria, in addition to the areas around Cairo, had the most unenviable reputation in producing sandfly fever outbreaks.

Especially difficult problems in placing troop sites developed with the falling back of the Eighth Army to El Alamein in June and July, 1942. Forces were hastily gathered together for the defence of the Nile Delta, Alexandria and Cairo. There was no avoidance for them of the populated irrigated regions. They were subject consequently to the hygiene hazards
already mentioned—flies, mosquitoes and too close contiguity to native communities. In addition the canals were a danger from schistosomiasis and general excremental pollution. Urgent orders and vigorous hygiene supervision were arranged to bring home to these troops the hazards of the Delta environment.

(2) Sanitary Services.—Having obtained as clean and as disease-free areas as possible, emphasis had then to be placed on their maintenance. This led to standards of camp and barrack cleanliness being made very strict and of efficient services of disposal for waste products being provided. By a combination of propaganda and discipline, camp and barrack cleanliness came, in time, to be excellent. This was no mean accomplishment, as the average urban-bred civilian soldier is by nature extremely careless of his physical environment. He has become accustomed to having litter, waste paper and night soil disappear effectively without any effort on his part. He has to have habits instilled in him so that he, first, himself does not add to the litter and filth of his environment and, secondly, personally feels a responsibility for cleaning it, even if someone else made the mess.

In the Middle East, sanitation was ever an important part of hygiene work and, in keeping with British Army practice, much ingenuity went in improvising apparatus and structures for burning refuse, treating waste waters and rendering human excreta innocuous. The general methods do not require description in this article as they are so well known, being found in all current textbooks of field sanitation. A few of the more interesting local problems and developments, however, deserve a few notes.

(a) Bathing Facilities.—As personal cleanliness is an important routine in promoting general bodily health, as well as in preventing skin diseases, persistent pressure was applied by the medical authorities in seeking adequate bathing facilities in all areas. In Base and L. of C. areas the matter was relatively simple. Here standard bath-houses supplying hot and cold showers were erected. The forward units, especially in the deserts, had too frequently no chance of general baths. Near the coast the sea was enjoyed by all and its usefulness increased by the issue of sea-soap. Much experiment and trial produced several improvised bath sets approaching the ideal, viz. light, easily transported and erected, sturdy and using little water. These were also an advantage in temporary camps and for such special tasks as dealing with refugees infested with lice. A large scale improvised bathing centre, formed from several of these special portable sets, overcome the difficulty of cleaning and disinfecting the scores of thousands of Italian and German prisoners taken in the El Alamein advance.

(b) Refuse Disposal.—Middle East experience has amply confirmed the advantage of incineration of garbage, refuse, etc. Mere burying is rarely done properly enough to prevent fly breeding. However, in forward areas, incineration on occasions could not be employed because of attracting enemy attention. In operation areas the general problem of waste disposal was much intensified by the enforced dispersal of men and vehicles. Early on, this had produced so-called vehicle cooking. Each group of men in a vehicle, troop-carrying lorry, armoured-car, gun or tank being isolated from their fellows came to fend for its own food. Apart from its evils of improperly prepared meals, dispersed vehicle camping also scattered refuse and waste products in an uncontrolled fashion over all camping areas in the desert. A policy was defined therefore in 1942 to return to company cooking, arguments securing this being both those in favour of preventing scattering of refuse and equally, if not more important, those emphasizing careful preparation of true meals instead of “feeding out of a tin.” This eased the problem of refuse disposal in forward areas considerably and contributed much to lessening the fly nuisance.

In more stable base and L. of C. areas the handling of refuse approached civilian conditions. Wherever the size and siting of camps allowed, the controlled tipping method of disposing of refuse was adopted. The general recommendations of the Ministry of Health were followed, e.g. deposits made in layers of not more than 6 ft. 0 in. depth with each layer covered by at least 9 inches of earth and the whole process kept under the most rigid hygiene supervision. Following experience elsewhere, the method proved successful in the M.E. provided supervision was never relaxed.
(c) Waste Water Disposal.—One of the fortunate features of handling waste water in most areas of the M.E. is that the dryness of the climate and the strong sunlight results in evaporation methods being particularly successful. Wherever possible, therefore, waste water was run into a series of pans to allow this process of evaporation to take place under the optimum conditions. Each pan had a hard, smooth, level floor and was provided with a containing border of approximately 2 ft. Usually the workings of the pan system of disposal provided for the following schedule: Day 1—Pan filling; Day 2—pan evaporating; Day 3—floor of pan covered with film of mud, slightly smelling; Day 4—mud adhering but dry with no smell; Day 5—mud cracked and peeling off in flecks; Day 6—dried mud flecks brushed off and packed on top of ridge and pan ready for use again.

In certain areas waste water was disposed of through irrigation channels by which quantities of excellent vegetables were obtained. It was remarkable to see, for instance, in the desert areas, how enthusiastic hospital O.C.S. units were able to obtain most excellent additional vegetable supplies by careful distribution of their waste water into desert vegetable gardens. This method was stimulated wherever possible. “The nigger in the wood-pile” of waste water disposal seems always to be the grease trap. In spite of much education, local engineering services frequently neglected this most important apparatus by constructing traps without the essential principles of adequate capacity and properly placed baffles and inlet and outlet pipes. This weakness too frequently was responsible for improper waste water disposal and serious insanitary conditions.

(d) Night Soil Disposal.—The present Middle East campaign has seen the vindication of a policy of using deep pit latrines wherever possible. During the years in question, all permanent and semi-permanent camps were converted to this system with obvious improvement over the previous bucket removal system. There were no particular novel features in the deep pits used but, as always in sanitary control, direct adherence was necessary to the principles of construction and maintenance, e.g. adequate depth with an absolute minimum of 8 ft., the provision of fly-proof superstructure, and constant inspection to remedy any wear and tear or carelessness in their use. A special problem in the maintenance of deep pit latrines, as with other camp structures, arose when large camps were temporarily unoccupied as it was quite impossible to provide sufficient guards to hold off marauding thieves. Latrine structures were damaged and contents exposed to fly breeding. In these circumstances deep pits were sprayed with a mixture of boiler oil and tar oil to prevent fly breeding. In the forward areas, especially in the Western Desert where the subsoil was of rock, making the construction of deep pits impossible, the problem of innocuous disposal of night soil was solved by the introduction of the incinerator latrine. For this, petrol tins were used as receptacles and twice daily incineration of contents was obtained by ignition of a small quantity of petrol and some oil. With careful maintenance one of these latrines was shown to last 15 men for a fortnight. The bore hole latrine had little application in the M.E. as troops were rarely sited in areas where such structures could be put down.

(e) Fly Control.—It is convenient to mention briefly some of the main features of fly control, the fly being one of the most irritating features of the M.E. environment. It was confirmed over and over again that, except where a unit was placed right in some civilian community, camps depended on freedom from flies on their own efforts. Camps with properly supervised refuse, waste water and latrine disposal could be as free from flies as any civil local authority equipped with full sanitary services. Therefore, in the campaign to eliminate the fly, emphasis was continually placed on these essentials. The results were completely satisfactory, as in the summer of 1943 the vast majority of Army communities were relatively free from flies and the average soldier had learned the lesson that camp cleanliness paid. The main problem arising in connection with flies, and one which threatened the fitness of the Eighth Army, was that associated with the retreat and the holding of the El Alamein line in the period from July to September, 1942. The disorganization following the retreat from Ghazala to El Alamein had produced a lowering of hygiene standards, disruption of hygiene supervision of camps and lines of communication, and a crowding together into the
area between El Alamein and Amariya of vast numbers of small units as well as hordes of Bedouin and native refugees. Literally appalling conditions of fly infestation developed. Flies were present in such incredible numbers that during daylight the men of the Eighth Army had no respite. For the fighting units in the forward lines this was an exceedingly serious matter as men, who during the night were awake on either guard or patrol duties, could get no rest during the day. General Auchinleck himself, therefore, backed up directly medical recommendations, which resulted in the refugees being cleared back from the camping areas and a special Fly Control Unit being organized to clear the whole area in and about the El Alamein defence line of fly-breeding materials such as dead bodies, litter, refuse, etc. In addition a vast quantity of mosquito netting was distributed amongst the men so that they could obtain peace for sleeping and resting during the day. These special measures fortunately were successful and by the end of September the problem had abated considerably with the fortunate result that excremental diseases never seriously weakened the strength of the Eighth Army. As has been shown in a previous article (Gear), it was otherwise with the Germans and Italians in the same area, where indescribably filthy conditions produced such a serious fly menace that the incidence of dysentery, diarrhoea and enteritis materially sapped both the man power and vigour of the enemy forces.

One technical point of some interest and importance that M.E. experience has revealed is the necessity of subscribing to certain principles in using fly traps. These are: that the traps must be placed away from cookhouses, dining halls, messes and latrines; they must be truly counter-attraction for flies to the above type of premises. Then traps must be of the proper size with full play allowed for light attraction and always properly baited with moist bait. Used in this way, it has been shown that fly traps literally do attract flies away from cookhouses, etc., and catch such enormous numbers as to lessen appreciably the fly population in the camp locality.

(3) Type of Accommodation.—In the early stages of the campaign, providing troops with accommodation was a difficult problem for the same reason that all problems were difficult, namely, lack of supplies and the necessity for improvising as much as possible. On the other hand the generally warm, sunny climate throughout most of the M.E. reduced the necessity for shelter. Initially, therefore, the majority of camps consisted merely of tents with fixed structures to serve as cookhouses and ablation and latrine blocks. This primitive provision, however, was improved with the increased availability of such materials as wood and cement so that gradually the more permanent camps came to have huts for all central services including cookhouses, messes and canteens, whilst gradually a policy of replacement of tents with huts for sleeping accommodation was pursued. Nevertheless, at no time was either labour or material sufficiently generous to allow of optimum standards being secured; therefore, as a compromise, a minimum space standard of 45 square feet per man had to be accepted for sleeping accommodation in huts. Similarly, the numbers in tents had to be increased above those allowed in peacetime. The situation was carefully watched but no untoward effects in the form of a rising incidence of respiratory disease occurred.

There were three types of accommodation provided, governed by the two main factors—permanency of the camp and the availability of supplies. These types were known as tented, partially hutted, and fully hutted camps. Partially hutted camps were on a scale which supplied tents for sleeping accommodation and for messes, but huts for cookhouses, canteens, latrines and ablation blocks. Medical concern in the hutted camps lay largely in securing the adoption of standard designs covering billets, cookhouses, bath-houses, latrine blocks, and in the proper distribution and layout of buildings within the camp area. Wherever possible, hospitals were naturally put on to a fully hutted scale. Air-conditioned accommodation would have been a very welcome advantage, especially in Egypt during the summer months, but the extremely limited number of air-conditioning plants available prevented any general use of this principle. It was, therefore, limited to certain operating theatres and to the hospital at Massawa.

Though not entirely eliminated from Middle East military accommodation the notorious
The Health of the Middle East Force, 1942-1943

The bug is now right back on the defensive even in those historic haunts of his in Cairo, the Kasr-Nil Barracks and the Citadel. This has not been the result of any such magical insecticide as D.D.T., but of a rigid comprehensive regime followed by every unit itself dealing with bug harboursages such as wall cracks, regularly turning out into the sun all bedding and movable fittings, and regularly cleansing premises with paraffin emulsion.

H. PROBLEMS WITH RACIAL AND CIVILIAN FEATURES.

(1) Allied Forces.—It will have been gathered that the racial heterogeneity of the Middle East Force did not simplify hygiene administration. In most continental armies hygiene is scarcely recognized so that a considerable inertia and even opposition had to be overcome before most Allied formations would accept the necessity of having a hygiene organization or of following sanitary principles in laying out camps, taking preventive measures against disease, etc. A frequent argument was that the Army in question had to fight, that it was tough, and quite impervious to such minor afflictions as dirt, flies and disease. If the British were queer enough to worry about these things they should employ native labour to clean up camps and not submit real soldiers to the indignity of picking up litter! Some groups were never really converted. Their camps, bivouacs, etc., remained filthy, and the incidence of preventable disease confirmed their disdain of hygiene. A notable exception was the Polish Corps. Composed of soldiers evacuated in 1942 from Russian Turkestan, via the Caspian and Iran, it was at first disinterested, but by the time it went into action in Italy, its practice in sanitation, fly control, malaria prevention, was an example even to British regular units.

In most continental Allied armies the status, or rather lack of it, accorded to unit medical officers is not helpful in effecting hygiene control. In certain services such an appointment does not even carry commissioned rank. This lack of authority, combined with the absence of any direction giving commanding officers responsibility for maintaining the health and sanitary conditions of their units, raised almost insuperable obstacles to proper hygiene practice. On several occasions a unit medical officer, fired with hygienic zeal, correctly giving an adverse report on camp conditions, and calling for vigorous action, has been threatened with disciplinary action for his impudence! Only continuous, tactful propaganda, countered such unsatisfactory attitudes to Army hygiene. In the two years, however, steady but slow progress was achieved in most units, and so reduced their danger to themselves and their neighbours.

Initially each Allied force claimed its own ration scale, incorporating items to its racial taste. With few exceptions, however, the Middle East Field Service Scale was eventually adopted in place of national ration issues. The practice of insisting on central kitchen and messing areas, even in the field, was new to some Allied formations. These too frequently cooked and fed as individuals in their own bivouacs, tents and huts. Insanitary conditions arising from such a practice were deplorable and resulted in it being expressly forbidden.

(2) African Personnel.—These are singled out for some comment as their participation, both in modernised war and in the Mediterranean area, was novel. Many health questions arose from this. The emphasis on acclimatization in their case has already been mentioned, as well as the inclusion of bulky cereals in their ration scales. Their inborn physical pride, love of cleanliness and discipline assisted in their rapid acceptance of hygiene practices. Camps occupied by such units as African Pioneer Corps Companies were usually conspicuous by their orderliness and cleanliness. Their mimicry of the European, and not actual necessity, led to their insistent demand for headgear and footwear. The characteristically broad African foot was conveniently accommodated by the broad fittings of the standard British Army boot, so that only a limited demand for special African fittings arose. In winter, special care, as already mentioned, was taken to protect them by securing hut accommodation, extra blankets and such additional items of clothing as pullovers and cap-comforters. No serious incidence of respiratory disease arose. The occurrence of pneumonia in West Africans in Cyrenaica has been discussed in an earlier section. No serious developments occurred as a
result of large bodies of tropical Africans, and therefore including carriers of such conditions as malaria or schistosomiasis, arriving in the Middle East. Some Congo Africans, where initial selection had not been strict enough, showed undue incidence of sick, but on the whole Africans arrived and remained fit. The medical problem giving most concern with all Africans was venereal disease. The African with his undeveloped sense of responsibility and with little inclination to control physical urges is not touched by the usual appeals of education and propaganda made to Europeans. His resultant promiscuity and unconcern in its consequences produced a heavier incidence in gonorrhea, syphilis and soft sore than in any other group. A comprehensive campaign of discipline, treatment, welfare, and tribal and racial pleas at the most only kept the problem within fair limits.

(3) Occupied Enemy Territories.—The medical and health supervision of the three occupied enemy territories, Eritrea, Cyrenaica and Tripolitania was an interesting variation to the usual military routine. To fulfill the Geneva Convention stipulations generously and yet to convert the previous showy, ill-balanced, extravagant Italian medical services into an efficient organization, giving due weight to preventive medical and public health, was not a simple task. Initially, the intolerable insanitation of such key places as Asmara and Massawa in Eritrea, Derna, Benghazi and Barce in Cyrenaica, and Tripoli had to be eliminated so as to make these areas safe for British forces as well as for their own inhabitants. The drive of the British Principal Medical Officers and their local British health inspectors had, within a year, got the gross filth of generations removed, efficient sanitary and water services functioning, and basic hospitals, dispensaries and clinics providing essential medical care for the civil population.

When the medical stores left by the Italians were consumed, Army stocks were drawn upon to supply all essential pharmaceutical and disinfectant items. Hospital equipment was maintained so that the large hospitals in Asmara and Tripoli, for instance, continued to function as fully as ever. In keeping with British practice two main lines of development were followed. First, the improvement of sanitation and health of all urban communities as mentioned above. For this purpose a British health inspector was appointed to supervise each large community, and an Italian and native staff appointed to remove refuse, clean up war-shattered areas, disinfect lousy populations and control malarious areas. Secondly, a system of dispensaries providing simple first aid and preventive care, e.g. for eye conditions, was evolved in each territory. This, for the first time in most cases, gave such modern public health facilities as child, school, and maternal care to the territories. The fortunate freedom of the occupied countries from any large-scale epidemics, mass ill-health or malnutrition is in a large part the outcome of the more efficient and comprehensive medical and health services brought in by the British. This help was given too without any large demand on the British taxpayer. The British staffs consisted of a principal medical officer, less than six assistant medical officers, less than a dozen health inspectors and a small group of stores and office personnel. Each staff controlled a fairly large number of Italian and native medical officers, technicians, and nurses. In Eritrea and Tripolitania medical institutions were only slightly damaged, but in Cyrenaica damage and disappearance of equipment and stores meant a new beginning in every respect.

(4) Allied Civilian War Organization.—The Middle East for strategic and economic reasons, as has been seen, became self-contained to a considerable degree. The chief organization in achieving this on the civil side was the Middle East Supply Centre under the jurisdiction of the Minister of State. In its functions of controlling the distribution and import of food and medical supplies it had much in common with the Army. A liaison was therefore provided by officers of the Medical Branch of G.H.Q. serving on the relevant standing committees. The available shipping space and medical supplies were thus allocated between the Army and the various local civilian communities to the best advantage of the war effort. Only some instances from the very large number of important and interesting medical problems dealt with by this organization are possible here.

In 1943, the Governor of Aden reported the occurrence of strange cases of nerve disease apparently associated with flour from Abyssinia. The Army and Air Force immediately
provided experts who traced the mystery to native wheat contaminated with *Lolium temulentum* ("tares"). The necessary preventative measures then became possible. These were—prohibition of Ethiopian wheat until it had been cleaned, and advice to the original producers of the grain in Ethiopia as to how to prevent contamination of their fields with lolium and how to mill wheat from such areas so as to exclude this harmful contaminant.

Another example of work of a medical nature undertaken by M.E.S.C., in which the Army authorities participated, was the occurrence of malaria carried by *Anopheles gambiæ* in Upper Egypt. The epidemic which arose was serious both for the civilian and military authorities. To the former the problem meant dealing with vast numbers of sick and dying people, and to the latter there was the threat of interference with war traffic along the Nile and with the local production of food supplies which, in part, were used by the Army. The military medical authorities, therefore, gave strong support to the request made to M.E.S.C. for the urgent supply of such anti-malarial stores as paris green and mepacrine. These stores were accordingly early secured. Similar essential medical stores and disinfectants were supplied, on the concurrence of the military authorities, to such civilian States as Palestine, Syria, Lebanon and Cyprus. Supplies, apparatus and assistance were also provided for the Saudi Arabian Government in handling the annual pilgrimage, via the Red Sea port of Jedda, to Mecca.

A further responsibility of a civilian nature which had to be borne, in its medical planning aspects, practically entirely by the hygiene staff, was that of the preparations made for the re-occupation by the Allies of the Balkans. This was a thorny problem indeed. It suffered from the lack of reliable information of the actual disease incidence, malnutrition, and the availability of medical supplies and stores in the respective countries. The supreme difficulty, though, lay in making staff preparations as the necessary technical personnel, such as medical officers, nurses, etc., were practically unobtainable. However, through the latter part of 1943, planning proceeded designed to give the quantities of essential food supplies, such as pressed meat, dried milk, sugar, pulses, etc., which were needed to deal with any mass deficiency which might be expected, and, in addition, the numbers of those medical and drug units which had been standardized by the Allied Post War Requirements Bureau to cover such things as simple medical treatment, first aid, maternity cases, surgery, etc. Recommendations were also made as to the skeleton advisory and liaison staffs which should be provided for the occupied territories to assist them in the transition from evacuation by the Germans to the time when civilian organizations could assume the responsibility for health and medical care.

This work depended for much of its direction and detail on consultations with a further civilian war organization, namely, the M.E. Relief and Rehabilitation Administration. For some time the medical staff at G.H.Q., M.E., acted as "ex-officio" advisers to the Director of this Administration. In such a capacity, military medical authorities became concerned in giving advice and assistance to the large organization which was gradually evolved for handling the various groups of refugees pouring into the area from the Balkans and the Aegean Islands. The military assisted with hygiene personnel, with arrangements for disinfestation of refugees, and with medical and health supervision in large refugee camps established in various parts of the Middle East.

(5) Relations with Middle East Civil Governments.—Apart from their co-operation in the work of such bodies as the M.E. Supply Centre and the M.E. Relief and Rehabilitation Administration, the Army hygiene authorities had direct concern in the general health conditions of the various civil communities. Each local medical authority was therefore charged with maintaining the closest liaison with civil medical officials, and observing such facts as disease incidence, food and water supply, malaria and typhus control, etc. The need for this interest is obvious, both for protecting the Army and the civil tranquillity on which the ease of military planning and operations depended so much. A civil State disorganized by an epidemic would have been a serious encumbrance to the Middle East Force.

In earlier sections food problems of the various territories were discussed. In their civil aspects military medical opinion was frequently required. The Egyptian cooking oil problem
became acute, and ground nut oil was selected as being a suitable substitute for the Native cottonseed oil. Palestinian citrus, with strong military medical backing, was eventually admitted into Egypt so that the troops could enjoy a higher fruit ration. Sudan meat and Syrian meat and Syrian dates were further local food products in which the Army was interested.

As a further example of joint military and civil interest the huge civilian labour forces employed by the Army may be instanced. From lowly road labourers up to skilled technicians a watch was kept over their health. Civilian practitioners and hospitals assisted the Army in giving medical care, while the Army provided, in many cases, rations, camp accommodation, facilities for bathing, etc. Trained industrial Army medical officers watched carefully over the needs of thousands of civilians working at lathes, work-benches and factory machines in Palestine, Syria and Egypt. Lousiness in all civilian labour was reduced to a minimum and so the threat of typhus removed. Loss of man-hours from accidents and minor illness was under continuous investigation and thus the output of clothing factories, accumulator works, tank and vehicle repair shops was maintained. Such steady health and welfare work was an important field of military and civil co-operation, but a more spectacular one was dealing with communicable disease. Though friction might easily have developed here, with civilian States anxious lest the military traffic introduce and spread disease, and the Army nervous of its man power and labour forces being crippled by endemic disease, there was a general happy co-operation throughout the year. Yellow fever was the threat from outside most feared by local civilian governments, especially that of Egypt. The Middle East Force did everything in its power to conform to the various precautionary measures such as the vaccination of personnel travelling through the endemic African areas, and the disinsectization of aircraft and shipping arriving in Egypt from infected areas. Smallpox cases arrived in shipping, on occasions, but vigorous vaccination and isolation of sick controlled the disease.

As far as endemic Middle East conditions were met the three provoking crises for both military and civil interests were plague, typhus and malaria spread by A. gambiae. Plague at various times appeared in Haifa and Jaffa in Palestine and in the Canal ports of Egypt. Some of the outbreaks in the latter areas reached serious proportions. The Army assisted the civilian efforts energetically by protecting its own personnel in the areas by anti-rodent measures and by vaccination. Typhus was a serious source of anxiety in the winters of both 1941-42 and 1942-43. In the latter season a major epidemic raged, especially in Egypt, though fortunately the mortality rate was not typical. A fair number of cases occurred in the civilian labour force of the Army. Military cases were isolated and scattered, though with some concentration in the urban areas. The usual high mortality in individuals over thirty was again noted. The winter of 1943-44 was fortunately fairly free of typhus.

The problem of the spread of A. gambiae, the dangerous vector of malaria, from its more usual haunts in the southern section of the Nile, northwards, was serious in both its regional and international aspects. It threatened the densely populated Nile Delta with a most serious form of malaria, which in turn would have become a potential source for its conveyance further afield into Asia, especially India. First noted in the present cycle in Southern Egypt in 1941 gambiae-borne malaria caused such severe illness and mortality in many districts as far north as Assiut, i.e. only two hundred and thirty miles from Cairo, as to affect food production in these regions. Here it is only necessary to state that the military services placed every facility at the disposal of the National administration, e.g. technical personnel to carry out entomological surveys and to assist in mosquito destruction, supplies of paris green, malarial, mepacrine, etc. No further spread in the years in question occurred but the problem still exists and the Egyptian Government is now examining the possibility of a large-scale eradication campaign.

I. INCIDENCE OF DISEASE AND INJURY.

(1) General Remarks.—How is the health of an Army to be estimated? Unfortunately, there is still no direct means of assessment which can allot exactly to health measures the positive influence they exert, say on an El Alamein victory, or in maintaining the confidence
of an Eighth Army after a retreat from Gazala. There is ordinary clinical opinion which confirmed that the average soldier in the M.E. looked at the optimum of his physical powers in his possession of a healthy skin, a clear eye, a brisk movement and a generally contented mind. There is the proof of achievement, for the forces of the Middle East were not overwhelmed by reverse, maintained morale for years, and then rose to the ultimate for a successful army in obliterating their opponents. Only a fit and healthy army could have accomplished these things against a strong enemy.

Though the positive instrument for accurate measurement of the health efficiency of an army is lacking, the negative index lies in the incidence of disease. Disease incidence is both a criterion of wastage of man power as a whole and, in the case of certain specific conditions, also of the degree of failure of preventive medicine. This index for the Middle East Force in 1942 and 1943 was based on hospital admissions which are given as ratios in the following table:

<table>
<thead>
<tr>
<th>Campaign</th>
<th>Battle casualties ratio per 1,000 strength</th>
<th>Non-battle casualties ratio per 1,000 strength</th>
<th>Total ratio per 1,000 strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Middle East, 1942</td>
<td>31.1</td>
<td>553.6</td>
<td>584.7</td>
</tr>
<tr>
<td>Middle East, 1943</td>
<td>22.5</td>
<td>490.5</td>
<td>513.0</td>
</tr>
<tr>
<td>France and Flanders, 1914-18</td>
<td>364.3</td>
<td>646.6</td>
<td>1,010.9</td>
</tr>
<tr>
<td>Macedonia, 1915-18</td>
<td>43.1</td>
<td>1,185.1</td>
<td>1,238.2</td>
</tr>
<tr>
<td>Egypt and Palestine, 1915-18</td>
<td>89.0</td>
<td>741.0</td>
<td>830.0</td>
</tr>
<tr>
<td>Mesopotamia, 1914-18</td>
<td>89.0</td>
<td>1,164.0</td>
<td>1,253.0</td>
</tr>
<tr>
<td>South Africa, 1899-1902</td>
<td>38.0</td>
<td>728.0</td>
<td>766.0</td>
</tr>
<tr>
<td>East Africa, 1914-18</td>
<td>32.0</td>
<td>2,244.0</td>
<td>2,276.0</td>
</tr>
</tbody>
</table>

These Middle East rates of hospital admissions are excellent, bettering the records of the last war, though it is admitted that direct comparisons cannot be made. This table also shows that the present campaign follows the general rule that disease is more damaging to the human strength of an army than enemy weapons. This was even true of the Middle East Force during its hectic periods of activity in 1942.

The detailed study of the hospital statistics of the Middle East Force deserves a report to itself. Here only a few salient features can be described. An interesting chart is that of the seasonal ratios of hospital admissions shown in Chart I. This gives striking visual confirmation of the importance of the summer conditions in causing hospital admissions. These were the excremental diseases, malaria, many skin conditions, sandfly fever and infective hepatitis.

Chart 2 lists the principal causes of admission in per cent of total admissions and as a ratio per thousand strength. The parallelism between the two years is clear, the only major exception being the change-over to Skin Condition and "Other Diseases of the Digestive System" as the most important cause of admissions. The second important fact made clear by the Chart is that the first six most important causes of hospital admissions are largely preventable—skin diseases, digestive conditions, accidental injuries, dysentery, malaria and venereal diseases. Even in 1942, the year of maximum operations, "Injuries in Action" occupied only seventh place. The chart is then a decided confirmation of the importance of preventable disease in the causation of human wastage in a theatre such as the Middle East.

(2) Some Specific Conditions.—The following conditions warrant some remarks:

(a) Excremental Diseases.—Though there is a largely common epidemiological background to dysentery, enteritis and gastro-enteritis, yet their bacteriological and clinical differences make classification difficult. It has not therefore been possible to give the exact incidence of this group, but if to dysentery is added a proportion of the group included under "Other Diseases of the Digestive System" to cover cases of enteritis, etc., then there is no doubt of the predominant position of excremental disease in the Middle East disease record. The efforts to control them are all mentioned in various sections of this report—education in personal and camp cleanliness, control of flies, food, food-handlers, water supplies, and sanitary services. This many-sided attack was fairly successful, but it is a campaign which is endless.
Depending so much upon the individual and unit sense of responsibility, it is difficult to maintain efficient control. Much thought had, therefore, to go into devising new propaganda methods to attract fresh enthusiasm each year for such unspectacular work as clearing up refuse, protecting cookhouses, maintaining latrines in good order, etc. Then, obviously, much more education is required before every individual is fastidious about the origin and protection of his food, and the automatic cleansing of his hands before eating, etc.

(b) Skin Conditions.—The dramatic influences of war—weapons, malaria, typhus, dysentery, venereal diseases—have clouded appreciation, and have even led to neglect of more common and, under many circumstances, more important causes of man power wastage. Two of these ordinary very serious causes in the Middle East were skin conditions and accidents. Skin and Areolar Tissue conditions resulted in hospital admissions to the extent of 56.65 per thousand strength in 1943 and 50.47 in 1942.

Under the heading of "Diseases of the Skin and Areolar Tissue" are included such items as boils, abscesses, epidermophytosis, "desert sores," impetigo, septic dermatitis, etc. The lack of interest of the Medical Services was reflected in the vague diagnoses and uncertain treatments common in this group of diseases. Investigation and its consequential suggestions for control were thus hampered. A steady insistence in orders, hygiene and medical memorandum and in propaganda was part of the programme to reduce skin conditions, while on
hygiene recommendations the Army administration set about providing ablution facilities, supplies of foot powder, and arranging for regular foot and skin inspections. Special attention was paid to desert sores and epidermophtyosis. A general note on the former will be found in a previous article (Gear, 1943). Tinea pedis was extremely common and, as usual, was most troublesome in summer. The following general preventive measures were instituted: regular foot inspections; regular use of Army foot powder, disinfecting vats of 1 per cent sodium hypochlorite solution in ablution rooms and bathing pools, regular washing of changing-room floors, etc., with cresol, prohibition of sharing of towels, etc.

(c) Accidental Injuries.—The lack of interest hitherto in accidents is regrettable, as they are a most serious detrimental influence on both the human and material resources of any army. Vehicles and other equipment are damaged and destroyed and human lives are cut short or their usefulness decreased. In both 1942 and 1943 accidental injuries led to 48 men

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**Chart 2**

- **PRINCIPAL CAUSES OF ADMISSION in per cent. of TOTAL ADMISSIONS**

- **GENERAL HOSPITALS — M. E. F.**

1943-1942

<table>
<thead>
<tr>
<th>Cause of Admission</th>
<th>Ratio per 1000</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
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<tbody>
<tr>
<td>Skin and L.A.T. excl. Scabies</td>
<td>56.65</td>
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<tr>
<td>Other Diseases of Digestive System</td>
<td>54.86</td>
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<tr>
<td>Accidental Injuries</td>
<td>48.72</td>
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<td>Dysentery</td>
<td>33.21</td>
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<td>Inflammation of Tonsils</td>
<td>22.77</td>
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<tr>
<td>Injuries in Action</td>
<td>22.47</td>
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<td>Pyrexia of Uncertain Origin</td>
<td>20.44</td>
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<tr>
<td>Diseases of Ear and Nose</td>
<td>15.87</td>
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<tr>
<td>Infective Hepatitis</td>
<td>14.66</td>
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<tr>
<td>Sandfly Fever</td>
<td>14.60</td>
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1943

1942
A. E. Richmond and H. S. Gear

per 1,000 of the Middle East Force being admitted to hospital. The record of deaths in hospital, which of course does not include deaths of individuals dying outside medical units, confirms the seriousness of accidents, for in 1942 and 1943 they were responsible for 31 and 30 per cent respectively of all hospital deaths. Even in such an active operational year in the Middle East as 1942 accidental injuries led to more hospital deaths than battle casualties.

As accidents caused such a large number of deaths it is not surprising that the proportion of serious injury was also high. This is borne out by the fact that orthopaedic centres in the period July 1, 1942, to June 30, 1943, handled only just over 3,000 cases due to battle casualties and yet nearly 6,000 cases of major bone and joint injuries due to accidents. This is a further disturbing index of the part played by accidents in causing serious damage to human material in an army. Major bone and joint injuries require considerable and specialized (and hence expensive) surgical care and time to treat. A large number of such patients also suffer a permanent loss of efficiency. All these conditions are theoretically preventable, and by bringing these extremely important facts to the notice of the administrative authorities, a stimulus was provided for a general campaign to reduce road accidents, accidental fires, industrial mishaps, etc. However, the problem is an extremely complex one branching out into all Army activity and but slow progress is achieved. As with so many problems of any public health administration, educating the individual to an awareness of the importance of his part is fundamental to improvement.

(d) Malaria.—A curious coincidence is that in both 1942 and 1943 the annual ratio per 1,000 strength of hospital admissions due to malaria was 29. Such a ratio is admittedly not alarming by comparison with calamities due to malaria in such campaigns as that of Salonika of the last war. Nevertheless, when it is borne in mind that on the whole the Middle East is only mildly malarious, a ratio of 29 is not completely satisfactory. Broadly speaking the whole of the Middle East, excluding the true deserts, is malarious. Within this general malarious region certain areas are particularly dangerous such as the Jordan valley and certain places along the Palestine and Lebanon coastal plains. The primary function undertaken by the Army malarial organization was therefore to determine accurately the geographical variation of the malarial hazard. Initially three, but latterly two, Malaria Field Laboratories were available for this work. Within a few months the main malaria surveys were completed. For such areas as a large part of the Lebanon and Syria these were pioneer studies. The malaria season was taken as covering the period from the beginning of April to approximately the middle of November, except in the Sudan and Eritrea where it continues throughout the year. The common vectors were: Anopheles pharoensis in Egypt, A. gambia in Upper Egypt, the Sudan and Eritrea, A. superpictus and sacharovi (elutus) in Palestine, the Lebanon, Syria and Cyprus. A. claviger is common in Palestine and the Levant and was a frequent cause of sharp, local outbreaks sometimes mysterious in origin. Other vectors of not such general importance are A. sergenti, A. multicolor.

It is not possible to describe the comprehensive anti-malaria control organization in detail. It was designed to maintain constant observation on the ecology of the various Anopheles vectors, develop new methods of control, undertake general anti-larval measures through special malaria control units, and train and supervise units and camp staffs in anti-larval, anti-adult and personal protection measures. Advisers at each command headquarters, local hygiene officers and sections, two malaria field laboratories and nearly thirty special malaria control units, employing large gangs of labourers, composed the special Middle East control organization.

The lessons learnt were not really new. The chief one was that the work of special units in dealing with mosquito breeding and adult destruction, though frequently adequate in permanent camps, simply must be supported by unit and personal effort in the field if malaria incidence is to be reduced to manageable proportions. Usually it is only a forceful example of an outbreak which drives this need home. Medical insistence that as no simple single drug, device or measure is a safeguard, all measures, including siting of camps, oiling or "Paris greening" of breeding places, spraying insecticides into sleeping and living quarters; wearing
clothing (long sleeves and slacks) to cover arms and legs, supplying insect repellent to exposed skin areas, sleeping under netting, and when necessary taking mepacrine as a suppressant, must be used, was only gradually accepted. As with so many preventive medical measures dependent upon the individual, malaria control is much simpler to plan than to execute. Only vigorous education, training and discipline secure success. This was exemplified several times. A battalion on dispersed guard duty along a Syrian border, in spite of over a year's experience in the Middle East, neglected such precautions as checking that all men were wearing slacks, applying mosquito cream, and using sleeping nets, with the result that scores of cases occurred in a few weeks. Rigid application of these protective measures, with mepacrine suppression, abruptly ended the outbreak. In Syria, a brigade moved into a semi-permanent camp, and, discipline again being lax in supervising the adequacy of both local mosquito control and personal precautions, suffered serious sickness. These local instances, complementary to the losses due to malaria in the Sicilian campaign, converted completely the Army administrative authorities to the importance of malaria prevention. It is almost a psychological law that no amount of propaganda, exhortation or training will, in the actual absence of the hazard, make an army malaria-conscious. Actual experience and direct knowledge were the most potent influences in the Middle East in such conversion.

(e) Venereal Disease.—Hospital admissions due to venereal diseases were 31.4 per 1,000 in 1942 and 22.8 per 1,000 in 1943. The proportion of types was approximately, syphilis 8 per cent, gonorrhoea 28 per cent, venereal sore 32 per cent, other forms 32 per cent. The significant figure here is the high proportion of venereal sore. The venereal disease problem had been anticipated with some anxiety. A large heterogeneous mass of soldiers in wartime, in the circumstances to be found in the Middle East, seemed destined for much venereal infection. The usual preventive and treatment measures which were taken to meet this eventuality do not need special description. There were education and propaganda mainly through unit medical officers, provision of personal prophylaxis and unit early treatment centres—in the case of large urban areas centrally situated prophylactic ablutionary centres—special hospital treatment, and finally a vigorous and comprehensive programme of sports, recreation and welfare.

However, a short reference to the special problem of brothels is justified. In practically all urban areas in the Middle East brothels were flourishing and were the preponderating potential source of infection. A strong medical demand for placing such premises in the Middle East out of bounds to troops was based on the following arguments:

(i) They were far and away the most likely source of venereal diseases both from their nature and their easy accessibility. No such volume of contacts as occurred in brothels could be visualized as being possible through street or secret prostitution.

(ii) Such premises were almost invariably insanitary themselves and situated in most insanitary, sordid and degrading environments. Venereal diseases thus were but one of several health hazards to be met with in brothels. Typhus and scabies were distinct examples of infections, and doubtful drink and food were only too frequently consumed by patrons. Correctly, too, the medical authorities pointed out the influence of such conditions on morale, though perhaps such other factors as prestige and political repercussions of a policy of toleration of brothels lay outside medical judgment.

After some considerable discussion, where fears of the proposed policy were raised, brothels were placed out of bounds during 1942. The results have been watched closely. None of the expressed fears, such as intolerable conditions of street prostitution, or an increase in crimes of violence, or a deterioration in discipline, etc., have been confirmed. Generally the behaviour of troops has improved materially during the period since brothels were placed out of bounds, while venereal disease incidence significantly declined. Thus the early anxiety of venereal diseases becoming a burdensome problem has fortunately not been justified. This is a result due to the same general form of attack, employing all possible preventive, curative and associated welfare and disciplinary measures, as is required in dealing with so many problems of either military or civilian public health.
Industrial Hazards.—The elaboration of the Middle East into a vast war workshop made industrial medicine no mean function of the Army Medical Services. It is probably difficult for those who have not toured the Middle East in wartime to visualize the variety and size of the industrial hazards of such military installations as tank and vehicle repair depots, mine-filling factories, car battery and accumulator works, petrol-tin factories, food factories, etc. The protection of the working population in these installations so as to maintain and even to boost production was, throughout, an urgent duty. Special industrial medical officers were appointed to each area, and in each factory and depot were placed first-aid orderlies or nurses. These latter were usually locally employed civilians. Industrial plant was designed or modified to eliminate noxious fumes or dust. Working hours were watched so that the maximum compatible with optimum production was not exceeded. Refreshments on site and full facilities for ablution, etc., were arranged.

Two particular industrial hazards will give some conception of the type of problem met by the military hygiene authorities. First, there were the hygiene aspects of the enormous programme hurriedly launched to meet the need for millions of mines for the defensive line at El Alamein in July and August, 1942. Several T.N.T. mine filling factories were built. The following medical recommendations were adopted for their design and operation. The factories were designed to reduce dust and fumes to the minimum; inhalation of, and skin contact with, T.N.T. being the particular hazard in these plants. Parallel with this went full ventilation arrangements, including exhaust hoods at points of production of fumes or dust. Floors and tables were oiled and the whole premises frequently cleaned. All employees were selected, eliminating those with histories of jaundice, gall-stones, gastric, kidney or liver disease, and those reacting to a test for idiosyncrasy to dinitrochlorobenzine. Regular use of showers and hand basins was obligatory, while milk, for its general nutritive properties, was issued daily. These measures were entirely successful in protecting T.N.T. workers from poisoning.

The second interesting problem arose with the introduction of high octane petrol for all purposes in 1943. In the Middle East this meant definite risks of lead in the petrol filling factories. Several acute and chronic cases occurring in some civilian installations in Egypt served as an additional warning of the need for preventive measures. These were promptly introduced into military plants and were as follows: (i) The filling apparatus was modified so that petrol was discharged into tins without spillage; (ii) filling sheds were open as much as possible, in most cases being merely a roof structure; (iii) overalls for use by filling personnel; (iv) showers with hot water for use of personnel coming off shift; (v) rotation of work to allow personnel two weeks in three in a lead-free atmosphere.

Other Conditions.—The scope of this paper allows only passing reference to many diseases and conditions which presented preventive problems during the various campaigns. Typhus was throughout each winter a challenge to the Force more through its potential disorganizing of civil government and services than as a direct threat. The main features of the measures against it have been sketched above. Infective hepatitis struck one serious blow in the latter stages of the advance from El Alamein when hundreds of cases occurred in New Zealand, Australian and United Kingdom Divisions. Intensive research had not elucidated its epidemiological puzzles by the end of 1943. In 1942 its incidence was 16 per 1,000 strength and in 1943, 14·6 per 1,000 strength. The menace of sandfly in crippling large numbers of new arrivals in August and September has been indicated. Scabies was a nuisance only in Malta, where frequent direct contact of Maltese troops with their families produced many reinfections. Diphtheria was prevalent in only a few units, but at no time was sufficiently serious to call for universal immunization of the Force. Schistosomiasis, in spite of Egypt being one of the notorious endemic foci, claimed only isolated cases, a result to be ascribed to the placing of few troops in the irrigated areas and to the general knowledge of the origin of this disease in canals and streams. Tuberculosis as residence in the Middle East lengthened became more obvious. Typically it took the progressive infantile form in rural Africans, in whom it had most serious prevalence. With those few references this section
must close, but in a future publication an attempt will be made to give fuller statistical facts of disease incidence during these years.

J. Summary.

The diversity and size of the Middle East in its geographical, racial, and political features added to the extreme complexity of health problems in the mixed heterogeneous formations composing the Middle East Force. These difficulties were intensified by the years 1942 and 1943 finding the United Nations on the defensive resulting therefore in restricted supplies. The care of the Force was undertaken on orthodox lines with medical and hygiene administrative officers and units in each command and formation. The weakness of this orthodoxy lies in the tendency of the Army (and civil national services, too, it may be said) to concentrate on the executive care of medical units and casualties and to neglect to some extent less spectacular preventive and public health needs.

In the purely health sphere, accepting the fundamental principle that the individual soldier and unit must be self-reliant, considerable emphasis was given to health education and propaganda, using all the usual media of schools, lectures, demonstrations, leaflets, posters and films. The hazards of heat, light and local infections were met by such measures as a period of acclimatization for new troops, suitable clothing and equipment, and by the usual careful attention to pure water and food. Adequate balanced ration scales were not always easy to compose owing to shipping lack reducing imports of certain types of food. Local supplies were then exploited. Repeatedly, Middle East experience has shown the importance of protecting food from depot to the soldier's mouth to ensure its purity and its adequacy. The Army cook has at last come into his own. No food-deficiency disease occurred. The menace of the fly, the mosquito and the sandfly was met by camp siting, control of breeding places and intensive training of all troops in personal protection. Camp cleanliness was shown to pay. Special measures were needed to meet the quite phenomenal fly plague after the retreat from Gazala to El Alamein.

Sanitation and preventive medicine were novel ideas to most Allied formations in the Middle East Force. Conversion of these groups was slow, though the Poles eventually were most praiseworthy practitioners of military hygiene. Special care had to be given to the African, a newcomer to conditions of modern warfare and largely rural tropical in origin, therefore susceptible to crowd diseases. Captured enemy territories of Eritrea, Cyrenaica and Tripolitania were quickly cleared of long-standing insanitation and given better-balanced medical and health services for their native populations.

The Middle East hygiene authorities were also involved in various advisory and co-operative capacities with Middle East States in civilian problems of food supplies, epidemic diseases and medical stores. Typhus, plague, smallpox in several States, and malaria in Upper Egypt carried by *A. gambiae*, were acute civil problems affecting the Army. The success of the principles and application of military hygiene in the Middle East campaigns of 1942 and 1943 is partially measured by the low incidence of hospital admissions which were for the two years 553·6 and 490·5 per thousand strength. These rates are a distinct improvement on those of any previous wars. However, it is rather in the positive picture of health and vigour shown by the soldiers and their successful achievements in adversity and final victory that hygiene sees that it did not fail to play its part.

We have to thank the Director of Medical Services, Middle East Force, for permission to forward this paper.

REFERENCE.